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OFFICE: 4, LUDGATE HILL, LONDON, E.C.4.

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The Billingham Power Plant.

THE paper read last week before the Institution of Electrical Engineers, descriptive of the industrial plant erected by Imperial Chemical Industries, Ltd., to supply process steam and electricity to the Billingham-on-Tees factory of Synthetic Ammonia and Nitrates, Ltd., will be welcomed by all power engineers as representative of a model large modern pulverised-coal-fired, high-pressure, high-temperature installation.

The paper contains very complete data of considerable value. Apart from mere size, the great care that had to be applied to the many problems involved renders their solutions worthy of detailed study, the aim throughout having been commercial maximum economy rather than the theoretical maximum. Whilst the station will operate under favourable conditions, its designers set themselves no mean task, for they anticipate an overall thermal efficiency of 24.2 per cent. and estimate that the cost at the station's bus-bars of the electricity produced will be "well below" the kWh cost of any coal-fired station in the world. The latter expectation presumably takes account of the large proportion of the output generated in connection with the production of process steam, since the price of coal alone makes it possible to generate in some parts of the world at less cost, even at far lower thermal efficiencies. The annual output of Billingham station will be comparable with that of the largest generating station in Britain, and the consulting engineer must have had an unenviable task attempting to reconcile somewhat conflicting considerations when balancing maximum attainable economy on the one hand against reliability, flexibility, and simplicity on the other.

The value of the paper would have been enhanced by the inclusion of particulars of costs. The withholding of such information is, however, understandable in the present instance in view of the close relationship between the cost of electricity and the cost of manufacture of chemical products.

Space limitation precludes the reproduction (on another page) of more than a brief general outline of the paper's contents, but it will suffice to indicate that the design and lay-out of the plant are in several respects

unorthodox and quite novel in others; indeed, the production of some of it was entirely outside the scope of the manufacturers' shops, and constituted an important advance in design. Credit is due to the various contractors for the readiness and courage with which they undertook to comply with the unusual specifications that were necessitated by the multitude of new problems involved, especially in the view of the short time available, for the station was erected in record time.

The question naturally arises as to how far a new industrial power plant is justifiable when a supply of electricity is available from a public supply system. The circumstances are peculiar, and it may be inferred that the decision to install plant on the scale described was not arrived at easily. The load factor is high—approaching 100 per cent.—but this condition is not so favourable to independent generation as it is sometimes held to be. In a station having the usual difference between summer and winter conditions, the amount of spare plant required is only that necessary as stand-by over a short seasonal peak; overhauls can be carried out in the summer, whereas a high load factor necessitates the provision of stand-by when units are out of commission for long periods. It follows that for equal security in the two cases capital charges will be greater on isolated plant running at a high load factor. On the other hand, the effect on the power station capacity of a large public supply undertaking supplying energy to such a consumer is not important in the same degree, and the difference should be reflected in the kilowatt charge in competition with the standing charges of independent generation. Furthermore, the Billingham works are situated in close proximity to one of the most efficient power stations in the country, the North Tees station, with which it is electrically connected, though chiefly for providing an alternative supply for essential services.

An important feature of the situation is the large amount of steam needed in the chemical works, and it is clear economy to generate electricity in the course of reducing a relatively high boiler pressure to that requisite for other purposes. There remains the problem of the best means of obtaining the electricity not so generated. It was suggested during the discussion on the paper that uncertainty about frequency standardisation might have been a factor in the decision to install the additional generating plant and that if a grid supply had been available the decision might have been different.

However that may be, we think the circumstances are not such as to establish a precedent for the multiplication of industrial plant, if electricity from a public source is obtainable at competitive prices.

Oil-engines for Peak Loads.

The manufacture of a British land-type oil-engine of 9,000 kW is referred to in a paper (abstracted in our last week's issue) which was recently read before the Diesel Engine Users' Association.

The advantages of this type of engine, especially for short-period use, are becoming widely recognised, by reason of its negligible stand-by losses and quick-starting properties. During the discussion on the paper referred to more than one speaker expressed disappointment that these advantages had been overlooked in drawing up the national schemes, but it is not clear to us how they could have been utilised in the prevailing circumstances.

Generating stations are selected by the Electricity Commissioners and the Central Electricity Board from the most suitable of those already in existence. These happen to be steam stations and contain no oil engines of 9,000 kW or so; cases in which the use of sets of appreciably smaller capacity would result in tangible net economy are not easy to recall. The reason for this procedure is that the Board, for all practical purposes, cannot build its own stations and, even if it could, would not build them only to carry peak loads. Capital has already been sunk in the selected steam stations, and comparison must therefore be made between the operation costs of such stations and the operation costs plus capital charges of new stations, and so the economics of the situation clearly rule out new construction for single-shift stations.

If a national electricity supply scheme were being inaugurated *de novo* and there were no generating stations to take peaks at points remote from base-load stations, the question of erecting oil-engine stations, where the load was within the range of 9,000 kW sets, would have to be considered. It would, however, have to be considered in competition with that of the construction of steam-turbine stations with boilers fired with oil or pulverised coal, specially designed for peak operation. We do not know of a case in which such a design is employed, but, since operation costs would in these circumstances be of less importance than capital charges, the latter could be reduced by eliminating those refinements to secure fuel economy incorporated in normal designs, and the capital expenditure per kW installed should be materially less than the £15 to £16 mentioned in the discussion on the paper.

The Leipzig Spring Fair.

In this issue our special correspondent concludes his impressions of the Electrical Section of the Leipzig Spring Fair.

Particular attention is drawn to the exhibits in the switchgear section, and a brief description is given of a new type of high-voltage circuit breaker in which the arc is struck in compressed air instead of in oil.

The possibilities of compressed air as an elastic dielectric have been to the fore recently and a large amount of research work has been carried out in this country during recent years. For accounts of the latter the reader is referred to the papers read by Mr. E. B. Wedmore and his colleagues before the I.E.E. in December, 1928, and the E.H.P. Conference in Paris last June.

That these researches have not yet materialised in commercial form is due, we have good reason to believe, only to the traditional caution of British manufacturers. Although the fact that they have not yet thought fit to market this type of switchgear may deprive them of a certain amount of kudos, we are of opinion that their attitude is justified, as in the end it is the quality and reliability of British goods which has made, and will maintain, the national reputation.

A Notable Display.

In this issue we publish some illustrated notes upon a combined lighting and domestic electrical exhibit which has been arranged at the Charing Cross "Underground" station by E.D.A. and E.L.M.A. This very bright and attractive display has been placed in a very "strategic" position where it must attract the attention and interest of the hundreds of thousands who use that railway station.

Even the electrical man well acquainted with the wonders of the Lighting Service Bureau, and the possibilities of light as a decorative medium, must be attracted by this oasis of light. To the majority of the non-electrical public the display will be a revelation and will undoubtedly score a telling point for electricity.

British Electrical Industry.

In view of the increased attention which has recently been, and is still being, devoted to measures for securing the future well-being of our industries and of our race, a prominent part of the editorial space of the Electrical Review has lately been occupied by a number of articles written by special contributors who have had particular messages to express for the interest and guidance of our readers. A good deal of discussion is taking place, both in associated circles and in private friendly groups, from which it is apparent that the present situation arouses serious misgivings in the minds of some, and is full of interest for all. The recent articles from the pens of Sir Benjamin Longbottom and Mr. John A. Crabtree are followed to-day by one in very emphatic terms from Sir Hugo Hirst, Bart., regarding the growth of our electrical import trade.

A Menace to Electrical Prosperity.

The Rising Tide of Imports.

By Sir HUGO HIRST, Bart.

MANY tributes have been paid of late to the abounding prosperity of the electrical industry in Great Britain. At the recent meeting of the Westminster Bank, the chairman, Mr. R. Hugh Tennant, observed that "the engineering trades (during 1929) registered a distinct improvement on the whole, especially in the electrical, locomotive, and textile branches." Another bank chairman described the electrical engineering trade as "most active." The Lord Privy Seal, speaking about four months ago at the annual dinner of the British Electrical and Allied Manufacturers' Association, said that "the prosperity of the electrical industry is a good answer to those who doubted whether we could make an effort and whether, if we did, we could compete against the world."

These are typical utterances, and the cheerful impression they produce in the public mind is confirmed by the progress of the electricity supply industry, upon which the manufacturers of electrical plant and apparatus depend for the main part of their business. A few weeks ago the Electricity Commissioners issued their ninth annual report, recording an increase of over 110 per cent. in the production of electricity in public generating stations since their first report was issued—for the year 1920-21. During last year there was an increase of close upon 10 per cent. in the output of electricity.

Elliott & Fry] *[London.*

Sir Hugo Hirst, Bart.

As a result of the Electricity (Supply) Act, 1926, the Central Electricity Board has undertaken the reorganisation of the generation and transmission of electricity on a national basis; and the outstanding effect of its operations is the spending of millions of pounds every year on generators, switchgear, transformers, cables, and other heavy electrical plant. A total of £34,000,000 is indicated as necessary for the completion of the plans already drawn up by the Board; and the numerous controversies over the effect of pylons on rural scenery witness to the vigour with which these plans are being pursued.

Railway electrification, moreover, is being pressed forward; the use of electric power has become standard practice in every branch of industry; the domestic applications of electricity are expanding daily; broadcasting has created a new world of electrical demand; research and invention are constantly opening up fresh possibilities for the electrical manufacturer. On every side there are signs that we are advancing rapidly towards the consummation of "The Electric Age." Producers in other and less fortunate branches of industry envy, with good reason, the progressiveness we display, the confidence that inspires us, and the uncharted possibilities that still lie in the future.

The picture thus presented is so encouraging, and encouragement is so much needed to-day, that one is reluctant to draw attention to a feature which has already begun to cast an ominous shadow over the brightness of the electrical outlook.

Great Britain prides itself upon having the largest volume of electrical exports in the world. But it is a matter for misgiving, not for pride, to discover that while our electrical exports last year increased by about 6.6 per cent. our imports rose by 30 per cent. The growth in exports, although comforting, is not altogether reassuring. As the ELECTRICAL REVIEW observes*, "it cannot be said that the increase of £1,213,311 was commensurate with the great growth of electrical development in all parts of the world." We are, in fact, doing no more than hold our ground in the export field; while, on the other hand, we are losing, and losing rapidly, in the field of electrical imports.

When the stream of electrical imports is closely examined, a very significant fact is discovered. There was no serious increase, either during 1928 or 1929, in the imports of electrical machinery of the heavier type. But in the lighter "electrical goods and apparatus," which include domestic appliances, meters, instruments, wires and cables, small batteries, and a host of miscellaneous articles, the curve of imports rose steeply during 1928 and soared in almost Alpine fashion during 1929. Out of the total of nearly £8,400,000, representing our electrical imports during 1929, the small goods and apparatus accounted for over £6,500,000, representing an increase of close upon two millions in a single year.

While, therefore, the Central Electricity Board has, since 1927, let contracts to British manufacturers, we are faced with the disquieting fact that last year alone we imported electrical plant, goods, and apparatus to the value of £8,400,000, which we might well have manufactured at home. Moreover, the capital raised by the Central Electricity Board is expended solely on plant for the production and distribution of electricity. It is not recurring expenditure. When the "capital stations" and the "grid" are completed, the orders on that account will fall away and will be succeeded by much more restricted orders for extensions. The real abiding value of the initial expenditure of the Board lies in the stimulus that it will give to the utilisation of electricity by all sections of the public, through the provision of a cheap and abundant supply of electricity

* ELEC. REV., January 24th, 1930, p. 178.

throughout the country. The first harvest of orders for heavy electrical plant will lead to a continuous series of harvests of orders for electrical appliances of every description. It is to these harvests that the electrical manufacturers must look for the maintenance and increase of their prosperity as time goes on.

There is every reason to believe that within a few years' time the business thus evolving from the utilisation of electricity will represent anything from five to ten times the value of the contracts given by the Central Electricity Board for generating and transmission plant. The benefits, in increased employment and otherwise, resulting from this ever-increasing demand for a multitude of electrical commodities will be enjoyed not only by electrical factories, but also by the various industries from which these factories derive their materials. Moreover, the expanding utilisation of electricity by all classes of the population, both urban and rural, will create a demand for new types of current-consuming apparatus. To meet this demand, additional factories will be required, stimulating activity in building construction, in the machine tool trade, and in a hundred and one auxiliary industries.

The enterprise of the Central Electricity Board is therefore only the condition precedent to the development upon which the electrical industry bases its hopes of increasing public service and employing more labour.

Already it is evident that this essential foundation is crumbling beneath our feet. The expanding market which we have created for innumerable electrical appliances by our legislative effort, our capital, and our skill in heavy electrical engineering, is passing more and more into the hands of the importer. We have constructed a national machine in the hope that its unlimited potentialities would be realised for the benefit of our own people; and we find, as soon as the machine begins to operate, that the foreign manufacturer, the foreign worker, and the foreign taxpayer are the main beneficiaries.

It is customary, when attention is drawn to the rising tide of imports in any particular industry, to accuse the manufacturer of inefficiency, either in methods of production or modes of salesmanship. No such facile evasion of the issue is possible in the case of the electrical manufacturing industry. Far from being backward, it has led the way in that process of "rationalisation" which is now the recognised hall-mark of sound organisation. The cable-making branch was the pioneer of co-operation among manufacturers. In the earlier days of the electrical industry our manufacturers struggled against the severe handicap of legislation which arrested electrical development in this country and gave our foreign rivals an invaluable start of more than six years. By tenacity, by inventiveness, by business skill, they established and extended their factories in the face of open competition of the most relentless character. Before the war they had set up the machinery of mutual aid in the form of the British Electrical and Allied Manufacturers' Association. During the war, when the vital importance to the nation of large-scale electrical manufacture had become manifest to all, they carried through a series of amalgamations which strengthened their organisation, increased their technical and commercial efficiency, and enabled them to undertake scientific research on an extended scale. The distributing sections of the industry are likewise highly organised.

To-day, as I have shown, the prosperity of the electrical industry is seriously threatened in a direction which is bound to become increasingly important year by year. The tide of imports is rising; and no barriers which the industry can erect in the way of higher efficiency, improved organisation, or greater enterprise in salesmanship can arrest the flow. The prosperity which the industry enjoys is partly a consequence of its own progressive effort and partly of the patriotic support which it received from all directions during the years immediately following the war, when the industrial lessons of that conflict were still vivid in the public mind and brought about a sentimental protection equivalent in effect to safeguarding. Certain sections of the industry still enjoy a large measure of that preference. The expenditure of the Central Electricity Board, for example, is rightly confined within our shores. Many public bodies follow the policy of stimulating employment at home by giving a preference to British manufacturers. These measures have been welcomed everywhere for their beneficial effect. But the wide field of electrical "goods and apparatus" lies open to the invader and is being exploited by him, regardless of the repercussions on unemployment, and cognate problems. Such a development would be deplorable enough in any circumstances; it is doubly deplorable when the opportunity of alien conquest is provided by the very developments of electricity supply which the State has fostered by legislation for the benefit of British interests.

It is abundantly clear that the electrical industry is helpless before this invasion. The attack comes from countries where the electrical manufacturers have an enormous market absolutely secured to them. Thanks to their security, they can realise to the full the advantages of mass production; and they can easily dispose of surplus output in our open market at prices far below the lowest level possible to British producers. Even where the British producers are well established, the difficulty of meeting this type of competition is overwhelming. Where they are planning to build up a new line of manufacture—as in the case of a number of electrical appliances for which a large demand has recently sprung up—their enterprise is arrested at the very outset by insurmountable obstacles.

There are only two directions in which they can discover any measure of hope. One is in the operation of patriotic buying; and this, as is apparent from the figures quoted above, is effective only in certain limited directions and is a rapidly diminishing safeguard. The other lies in recognising the necessity of extending to the products of our electrical and allied workers the protection which is now applied to the conditions of their labour. Measures are taken, and rightly taken, to raise their standard of living—to pay them good wages, to limit their hours of work, and to provide them with the securities and amenities of "social services" in a variety of forms. Everybody desires that these benefits should be maintained, and even increased; but how can this be done when our workers are subjected to open, highly-organised competition from Continental workers with a much lower standard?

The real wages of the German workman are on the average 68 per cent.; of the Belgian workman 54 per cent.; of the Italian workman 46 per cent.; and of the French workman 57 per cent. of those paid to the British workman. Apart altogether from the effect of security of mass output provided by Continental tariffs, these differences represent a handicap which no amount of organisation, reorganisation, enterprise, business efficiency, research, or any of the other methods of modern competition can counteract. Without some means of equalising basic conditions of labour, there is no escape from the alternative that the British worker must accept a lower standard of living or must surrender to his Continental rivals the increasing field of employment which the electrical industry provides. To this extent the case for a measure of protection is unanswerable.

Whatever needs to be done in this matter must be done quickly. The danger to which I have drawn attention is still comparatively fresh. It began to show itself clearly only within the last two years. It is, however, a manifestly increasing danger. The loss of £8,000,000 in electrical orders which might have gone to the relief of unemployment and taxation is only a faint index of the volume of invaluable business which, in this one section of our industry, we are surrendering to our competitors quite needlessly and without receiving any compensating benefit. When the plain facts of the situation are clearly realised, I feel confident that public opinion will support the action which is necessary to maintain the prosperity of an industry which I describe as the "shop-window" of a nation's industries, on account of its influence upon the progress of other vital forms of enterprise.

A Millboard Factory.

Electricity is used extensively at the works at Bourne End, Bucks., of Messrs. Jackson's Millboard and Paper Co., Ltd., where there is a self-contained electrical installation.

THE craft of the millboard maker is an ancient one, but unlike its sister craft, paper making, little has been written of its history or the methods employed, so that a description of the electrically-driven plant installed at the works of Messrs. Jackson's Millboard & Paper Co., Ltd., Bourne End, Bucks., one of the oldest millboard firms in the country, may afford more than passing interest to the engineer. Many years back Messrs. Jackson's recognised the advantages of electric driving, and installed their own generating plant, but the growth of the business called for yet more power and more heat, so that it was decided to remodel the whole of the mill, allowing for future extensions, and at the same time to provide the most economical generating plant, which would furnish power and heat simultaneously. After due consideration of alternative schemes Messrs. Jackson's decided to call in Mr. Leslie N. Burt, M.I.Mech.E., to advise them, and the whole of the work has been carried out under his supervision. The work was undertaken in two stages, the first being the reconstruction and enlargement of the machine house, and the provision of electric driving for all the board-making machines. As soon as the reconstruction of the machine house had been completed, the question of increased generating capacity was considered, and after carefully weighing the merits and costs of different systems the decision was made to install a steam turbo-generator of 50 per cent. greater capacity than the existing steam engines, leaving the latter as standby until a second turbo-generator should be installed. It was also decided to proceed with the increase of the production plant at the same time, as the mill was already working up to its full capacity. The contract for the turbo-generator, condensing plant and main switchboards was placed with the British Thomson-Houston Co., Ltd., and that for the various motors to drive the new machinery with Messrs. Newtons of Taunton, whose motors had been employed in the new machine house.

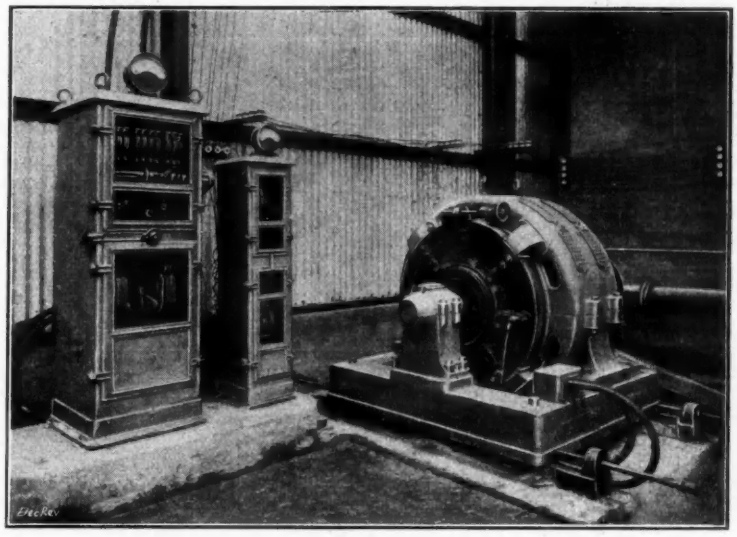

Fig. 1.—Large Beater Motor and Starter; 125 h.p.

Electrically, the factory is a self-contained one; generation is carried out on site, and, except for a small water wheel which provides about 15 h.p. and the use of exhaust steam for "process work," the factory may be described as "all-electric."

It was part of the reconstruction scheme to erect a new power house complete with modern and efficient plant, and the turbine at present installed is of 850-kW capacity, runs at 6,000 r.p.m., and drives through reduction gear a d.c. machine at 750 r.p.m. The

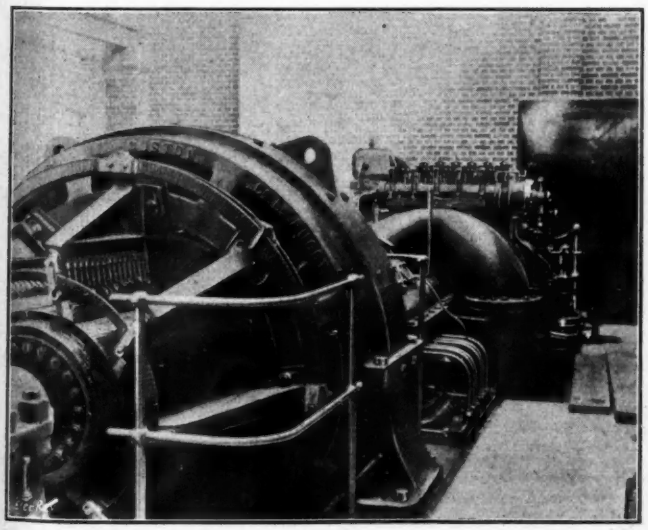

Fig. 2.—Turbo-generator Set; "Process" Exhaust.

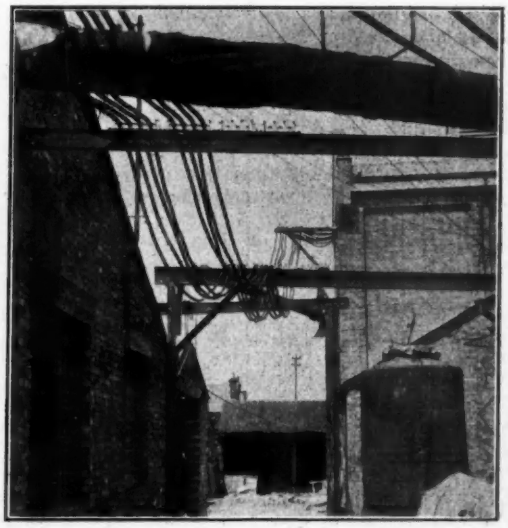

Fig. 3.—Distribution Cables from Power House.

present steam stop-valve conditions are 160 lb./sq. in. and 520-540 deg. F., at which the output of the set is 625 kW. Later, however, the steam pressure will be raised to 200 lb./sq. in., at which the turbine is designed to have a normal output of 850 kW. Normally about two-thirds of the exhaust from the set is used for " process," the remainder being dealt with by a surface condenser. Condensing water is taken from the River Wye, which runs through the factory site. There is an automatically-operated valve which keeps the exhaust steam at a constant pressure (just above atmosphere) and both the pass-in and pass-out steam are metered. Fig. 2 is a view of the new turbo-generator set.

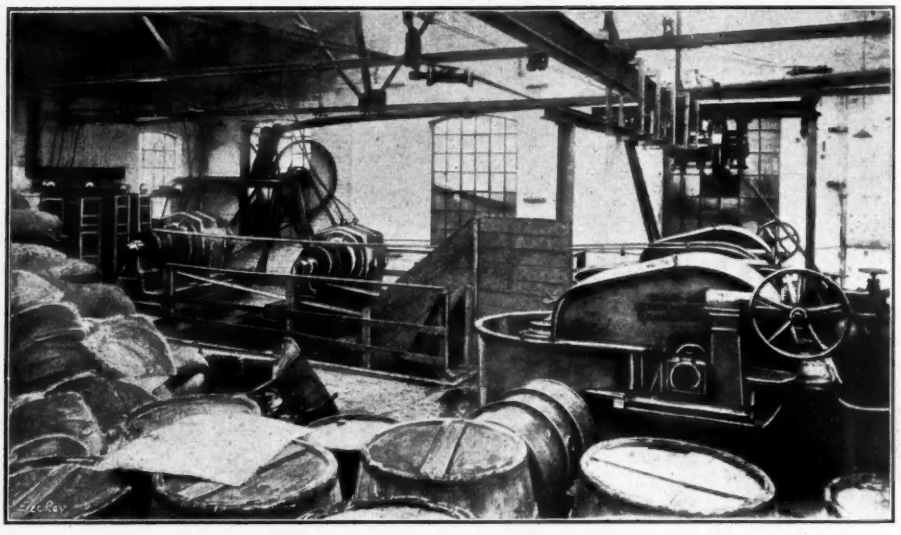

Fig. 4.—75-h.p. Motors driving Beating Machines.

Generation, distribution, and utilisation of the electricity are all at 230 V, d.c. Distribution throughout the factory, outside and in, is effected by v.i.r cables carried by porcelain insulators. It is the simplicity of the cable-work which is its feature. Fig. 3 shows the main cables leaving the power house. There are in all 68 motors of Messrs. Newtons', make in the factory, ranging from 5 h.p. to 125 h.p., and having a combined rating of 1,850 h.p. In all cases " Brookhirst " starting gear is employed.

To deal with the actual processes of the factory, we might refer to the products of the company in two main classes, high and low grades, and these are governed mainly by the classes of raw materials used. For both grades of products the first and essential operation is the thorough pulping of the material, and this is effected by beating engines. There is one large beater for the lower-grade product, and seven smaller machines for the better-quality stuff. Briefly, each machine consists of an endless-trough arrangement in which the mixture, raw material and water, is circulated and the fibres of the material rubbed out by means of a revolving drum in the trough, which is fitted with shallow blades or ribs on its surface, so that the fibres are rubbed out between the revolving blades and a suitable rubbing surface at the bottom of the trough. In order to allow even circulation of the pulp, there are breaks at the ends of alternate blades. Fig. 5 is a general view of the large breaker-beater. The revolving drum for rubbing out the fibres is in the left side of the trough, while in the right section is an extractor drum, into which pass the finer fibres of the mixture preparatory to their being removed from the machine. The main circulating and rubbing-out drum is driven by a 125-h.p. motor, 300 r.p.m., which is controlled by a multiple-lever panel. The various lever switches are operated by a single ratchet handle, which is moved in one direction only, with a single movement from " full on " to " off." If the handle is released in an intermediate position the circuit breakers at the base of the panel open and cannot be closed again unless the starter is returned to " off." All " making " and " breaking " is done on the main contactors, and these, in conjunction with the two overload trips, give complete no-volt and overload protection to the motor. In addition, there is a " safety first " isolating switch interlocked with the main contactors and with the doors of the case. The motor and starter equipment are shown at the rear of the beater in fig. 5, and a separate view of them is given in fig. 1. The extractor drum is driven by a 7½-h.p. motor, 1,000 r.p.m., mounted on girder work overhead. This is controlled by a " Brookhirst " drum-type panel, the general features of which are very similar to the multiple-lever

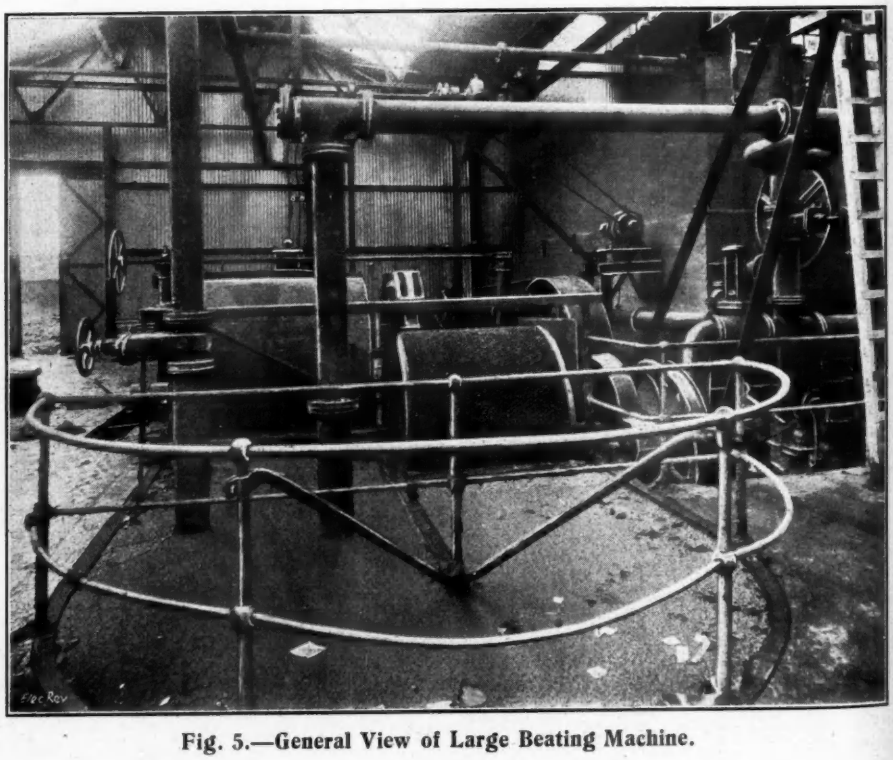

Fig. 5.—General View of Large Beating Machine.

type, except that the sections of starting resistance are cut out, not by individual lever switches, but by drum contacts and fingers. Similarly mounted is a 5-h.p. reversible motor (shown on the right of fig. 5) for operating a string catcher, a grid arrangement which is lowered vertically into the pulp mixture to arrest string and rubbish. This motor is controlled by a solenoid-type panel fitted with a reversing switch. Although the starter is operated by a single solenoid, there is nothing in the nature of a sliding contact. Instead, each of the carbon contacts makes a full-face instantaneous contact as the bar approaches it. In addition, the whole weight of the moving parts and the spring pressure behind these carbon contacts secures a positive return to "off," without any danger of "sticking." The starter movement is controlled by an eddy-current retarder. This control-panel has the same motor-protective and operator safeguards as have the multiple-lever and drum-type panels.

Five of the beaters for the high-grade products are driven from the main power shaft of the factory, and two are driven by separate 75-h.p. motors controlled by drum-type panels. Fig. 4 depicts the driving arrangements for the latter. While the larger breaker-beater operates practically on the continuous-flow principle, the mixture in the smaller machines has to be treated for seven or eight hours before it is removed.

(To be concluded.)

Electricity Supply at Bristol.

An illustrated description of the initial 40,000-kW section of the new capital generating station built by the municipality on the River Severn estuary at Portishead Dock, which is capable of extension to an ultimate capacity of 340,000 kW.

(Concluded from page 487.)

With the object of reducing pumping losses to a minimum the condensers have been installed in a pit 45 ft. below the turbines, to which they are connected by mild-steel trunks of 11 ft. diameter. They are of the central-flow type, the air being withdrawn from the centre of a nest of tubes and the steam admitted around practically the whole of the periphery, so as to reduce the pressure drop between the steam inlet and the air-pump suction and correspondingly increase the rate of heat transference. High condensate temperature, approximating to that of the exhaust steam, de-aerates the condensate in the condenser itself. The water box is divided, thus permitting half of the condenser being shut down. The system operates on a closed circuit; the condensate is withdrawn from the condenser by either one of two extraction pumps and delivered through two main and two auxiliary feed heaters to the boiler feed pumps. The main feed heaters are supplied with steam diverted from two low-pressure stages in the turbine, while the auxiliary heaters utilise exhaust steam from the steam-operated air ejectors and leakage steam from the high-pressure turbine gland, respectively. The temperature of the condensate is thus raised from 80 to 197 deg. F., with a corresponding gain in overall efficiency. A constant head is maintained on the system by a surge tank which absorbs fluctuations in the output of the extraction pump and the demand of the boiler feed pump. Make-up water is added to the system from evaporators operating with sea water and supplied with steam diverted from a low-pressure stage of the turbine. The vapour from the evaporators is discharged to the steam space of the low-pressure heater, no separate condensers being required. The evaporators are of the horizontal straight-tube type, having tubes of solid drawn copper. The extraction pump is fitted with special glands to prevent the leakage of air into the system. Stand-by tanks provide a reserve of evaporated water which is discharged as required into the condenser for de-aeration before entering into the feed system. Water-level indicators mounted on the gauge boards in the turbine room are connected to a red signal light. Illuminated indicator diagrams are provided for the condenser circulating water system. The circulating water pump pit has been sunk to a depth of 95 ft. from the turbine-room floor, and is of circular construction up to ordinance datum level, thence rectangular in section. The circular portion is 30 ft. in diameter and lined with cast-iron segments, the bottom of the pit being of reinforced concrete. The branches from the culverts are connected to flanges on the cast-iron lining, from the internal flanges of which a system of bus and interconnector mains 48 in. in diameter permits of any culvert being used at will either for suction or discharge, the direction of flow being determined by an arrangement of sluice valves operated by submersible motors controlled from the turbine room. Each condenser is normally served by two vertical-spindle pumps operating together, each normally delivering 8,750 gallons of circulating water per minute. The pumps are situated at the bottom of the pit and are driven through vertical shaftings by motors installed in the turbine-room basement, 80 ft. above. Each pump motor is fed electrically from a separate source, and its starter is electrically interlocked with the corresponding inlet valve. In the event of a fault causing a stoppage of either pump, the inlet valve of the pump affected will automatically close and the remaining pump in commission will enable the condenser to continue to function at reduced vacuum. Two general service pumps connected to the discharge side of the condenser circulating water pumps deliver water to the alternator air coolers and the turbine and transformer oil coolers; they are situated at 15.75 o.d. level and driven through shafting by vertical motors in the turbine basement. A reinforced-concrete tank has been provided as an additional sea-water stand-by.

An alternator of 25,000-kVA capacity at 11,000 volts, three-phase, 0.8 p.f., 50-cycles is directly connected to each turbine, with a house-service alternator of 625 kVA, 550 volts, 0.9 p.f. on the same shaft, together with a house-service exciter. The excitation of each main alternator is provided by two motor-generator sets, each capable of supplying the whole of the excitation current; each set is supplied from a separate source. The stator windings of the main alternators are of the basket (involute) type, the coils being former wound and placed in open slots. Ventilation is on a closed-circuit system, a fan being mounted at each end of the rotor, supplemented by an external motor-driven fan which delivers an additional supply of air to chambers at the back of the stator core. Adjustable dampers in the foundation block have been provided for light load conditions, when the motor-driven fan may be dispensed with, with a corresponding gain in efficiency; in addition, a further set of dampers for changing the ventilation system to open circuit has been installed. The rotor is a solid forging of 21 tons, and the completed rotor was tested to 25 per cent. overspeed at the maker's works.

The house-service alternator is generally of similar construction to the main set; it is ventilated by fans mounted on the rotor, the air being drawn from the main alternator system.

Each generating set is connected to the 11,000-volt terminals of a 25,000-kVA bank of transformers, stepping up to 33,000 volts. The equipment comprises six 8,333-kVA single-phase transformers and one spare. All switching and synchronising are done on the 33,000-volt side.

The main e.h.p. switchgear is of the metal-clad, compound-filled, draw-out type incorporating full interlocking features, the oil circuit breakers having a rupturing capacity of 750,000 kVA. The main busbar sections will be inter-connected by means of a synchronising bus-bar through suitable reactors, the whole forming what is known as a star reactance scheme. The two bus sections each controls the output of one 20,000-kW alternator; the third section now under construction will control a 50,000-kW set, but in this case the rupturing capacity of the switchgear will be 1,250,000 kVA. A total-load metering and recording panel is mounted in the control room, and separate total-load indicators are mounted in the turbine room and in the station superintendent's office. The protection of both main and auxiliary alternators is on the Merz-Price system. The 33-kV system is operated with the neutral earthed through limiting resistance, electrically-operated switches being connected in the " star " point of the step-up transformers. The generator neutral points are connected to earth by means of potential transformers, which afford sensitive earth protection to the generator windings without permitting heavy fault currents to flow. Automatic switches in the main and auxiliary alternator fields isolate the field circuits in the event of the protective gear operating.

The second instalment of buildings, which is now under construction, comprises an extension of the switch house and turbine room. The latter is being increased in length sufficiently to accommodate two 50,000-kW turbo-alternator sets, which will be disposed across the turbine room on each side of the second pump pit in a similar manner to the first two 20,000-kW sets already installed. The second pump pit, which has been constructed, is the same depth as the first, but is of 40 ft. diameter in the circular section, and is of hexagonal section, while the pit for the first two sets is square in section. It will accommodate on its six floors the condensers, circulating-water pumps, evaporators, general service and air and water extraction plant, feed-water heaters, and other auxiliary plant, and is provided with a lift and emergency stairways of easy gradient.

The latest set now in course of erection has been designed for a m.c.r. output of 50,000 kW at 0.8 p.f., on the main alternator, the economic rating being 40,000 kW. The speed of the set will be 1,500 r.p.m., and the two-cylinder turbine has been designed for a steam pressure of 300 lb. per square inch and a steam temperature of 800 deg. F.; it will have four stages of boiler feed-water heating, the temperature of the feed water being 280 deg. F. at the economic rating. The evaporating plant will be somewhat larger than that installed with the first two sets, and be capable of evaporating water from the Severn Estuary at 55 deg. F., equivalent to 5 per cent. of the condensate when the set is working at the economic load. The arrangement of the auxiliaries will be on similar lines to that of the first instalment.

The condenser, which is to have a cooling surface of 40,300 square feet, is to be of the two-flow type, designed to maintain a vacuum of 29 in. Hg. when supplied with cooling water at 55 deg. F., and dealing with the exhaust steam from the turbine at a load of 40,000 kW when operating under feed-water heating conditions. It is to be divided, and similar in all respects to those already installed.

The alternator is to be connected to the turbine by means of a semi-flexible coupling, and excited by means of two motor-driven sets, each of full capacity. The exciter motors will be fed from independent sources, so that in the event of a breakdown of either exciter set the remaining set will take over the full load. The house-service alternator, to be connected to the shaft of the main alternator, is to be of a capacity of 1,250 kW at 0.8 p.f., and similar in construction to the main alternator, but will be supplied with excitation current from motor-driven exciters, in which respect it will be different from the original sets. The internal reactance of the main alternator is to be approximately 12 per cent.

The complete equipment of the boiler house is in hand, and two Vickers header type boilers are now in course of erection. They will have a heating surface of 14,090 sq. ft., and be equipped with Illinois stokers substantially the same as the four units already installed. The superheaters have been designed for a total temperature of 825 deg. F. Somewhat smaller economisers than those of the first four boilers are to be employed, and air preheaters, owing to the increased feed-water temperature, are to be installed; the exit gas temperature anticipated is 270 deg. F. and the hot-air supply to the furnaces is not to exceed 250 deg. F. Independent " Sirocco " forced- and induced-draught fans, together with a flue dust extractor, are to be installed on each boiler, and in all other particulars the equipment is to be the same as that of the existing four boilers.

The requisite extension of the 33,000-volt switchboard, with provision for future reactors, is now being installed; the rupturing capacity of this section will, however, be increased to 1,250,000 kVA. The alternator is to be connected to the step-up bank of transformers of 62,500 kVA capacity by means of copper strap, and switching operations will be carried out on the 33,000-volt side, as in the case of the original sets.

It is anticipated that the whole of this extension, forming the second instalment, will be complete in time for the winter load of this year.

For the purpose of the South West of England and South Wales portion of the national grid scheme, Portishead is to be by far the most important seat of generation, the Central Electricity Board having scheduled the station as one to be used up to its installed capacity. Its development under the scheme is to be very rapid, as by the year 1942-43 the installed capacity will be not less than 240,000 kW.

For communication between the control and the turbine rooms loud-speaking telephones have been installed, together with electric telegraphs. Intercommunication throughout the station, offices, &c., is provided by a comprehensive system of automatic telephones.

All auxiliaries essential to the running of the station have been duplicated, and at least two entirely separate sources of power supply are available for each motor. Auxiliary switchgear principally consists of one 20-panel, 550-volt main board and two 10-panel, 550-volt " unit " boards. The former is the distribution board for station auxiliaries not intimately associated with the turbine and is supplied through two 800-kVA, three-phase, 33,000/550-volt transformers and, in addition, by the emergency house-service alternator. Each 10-panel " unit " board controls one turbine's auxiliaries, and is fitted with double busbars, one set being supplied from the auxiliary alternator on the main alternator shaft and the other set of bars being supplied by a feeder from the main distribution board. The system ensures that in the event of a disturbance on the main system one half of the auxiliaries of each turbine will remain unaffected, and a complete shut-down will be avoided. Both the main distribution board and the " unit " boards are of the metal-clad compound-filled type embodying the usual interlocking features. The oil circuit breakers have a rupturing capacity of 35,000 kVA.

Three distribution boards of the ironclad type, supplied from separate feeders on the main 550-volt distribution board, control the auxiliaries in the boiler room, turbine room, and the coal- and ash-handling plant. The various circuits are equipped with high rupturing capacity fuses.

The turbine room is spanned by an overhead electric

travelling crane having a maximum capacity of 100 tons, with an auxiliary hook of 15 tons capacity and change-speed gear incorporated in each hoisting unit. Two hand-operated cranes are installed in the h.p. switch house.

The voltage for the station lighting is 210 V, and the power is normally obtained through either one of two 100-kVA transformers from the main auxiliary switchboard. The installation is divided into essential and general circuits, and in the event of failure the essential lighting will be fed from a 1,000-ampere-hour battery installed adjacent to the control room, provision having been made on the control panel for the automatic change-over.

The transmission lines between the Portishead and Feeder Road generating stations, a distance of 13 miles, are 0.15 sq. in. in section, laid direct in the earth in two trenches, each containing three cables, the segregation of the trenches being arranged to avoid mutual heating. The cable is of the "H"-type with feeder joints enlosed in cast-iron boxes, run solid with compound, every 176 yards. Pilot cables, one of each feeder, are run in the same trench as the corresponding feeder cable and suitably protected against interference due to a breakdown of a main feeder cable. At Portishead the main feeder cables enter by way of a specially constructed jointing chamber under the switch house, whence the main cables are led to special jointing boxes, from each of which three lead-covered tails run in triangular formation, enclosed in steel trunking, to each feeder switch, the pilot cables being led direct to the main control board. As a departure from standard practice special temperature recording devices have been installed at a distance of about half of a mile from the Portishead station, and by a system of remote indicators the temperature of the cable is recorded under varying loads at the generating station. In the 26 miles of excavation 137,280 yards of cable was laid.

The power is transmitted in bulk to the Feeder Road station, where two 25,000-kVA banks of step-down three-phase transformers link up with the existing 6,600-volt system. The transformers at Portishead and Feeder Road are of the shell type, having forced oil circulation, with water-cooled oil coolers. The e.h.p. switchgear at Feeder Road is in two sections, identical in design with that at Portishead, and the control panels are housed in a separate room.

Direct telephone communication is available between the control room at Portishead and the Feeder Road receiving station, the lines being incorporated in the pilot cables of the balanced-voltage feeder protective gear.

The services rendered by Mr. Harley H. Dalrymple-Hay, M.Inst.C.E., the consulting engineer responsible for the design and execution of the condenser circulating-water culverts and sea works in connection therewith, are acknowledged with appreciation, as are also those of his resident engineer, Mr. G. M. Treharne Rees, A.M.Inst.C.E., and Mr. A. H. Gibson, D.Sc., M.Inst.C.E., M.I.Mech.E., Professor of Engineering at the Manchester University, who gave valuable advice on hydraulic matters.

Messrs. Vickers, Ltd., the main contractors, and their managers and agents, Metropolitan-Vickers Electrical Co., Ltd., are to be congratulated upon the successful execution of the contract, the organisation of their various sub-contractors, and the harmonious work throughout.

The principal contractors were:—Buildings: Wm. Cowlin and Sons, Ltd. Steelwork: Lysaghts, Ltd. Casements, balustrading flooring, &c.: Gardiner Sons & Co., Ltd. Boilers and steam piping: Vickers-Boiler Co., Ltd. Coal- and ash-handling plant: Mitchell Conveyor & Transporter Co., Ltd. Culverts: Charles Brand & Son. Screening plant: Ledward & Beckett, Ltd. Transmission cables: Siemens Bros. & Co., Ltd. Turbo-alternators, condensers, motors and control gear, switchgear, and transformers: Metropolitan-Vickers Electrical Co., Ltd. Ash-sluicing plant: Underfeed Stoker Co., Ltd. Automatic coal weighers: W. & T. Avery & Co., Ltd. Automatic telephones: Automatic Telephone Manufacturing Co., Ltd. Battery: Tudor Accumulator Co., Ltd. Boiler fans: Davidson & Co., Ltd. Circulating-water pumps: Drysdale & Co., Ltd. Clocks and siren: Gent & Co., Ltd. Coal and ash controllers: Daylite Electrical Co. Coal meters: Lea Recorder Co., Ltd. Drag-link conveyor: E. Pennis & Co., Ltd. Engine-room telegraph: Chadburn's Ship Telegraph Co., Ltd. Engine-room telephones: Alfred Graham & Co., Ltd. Feeder Road 6,600-volt extension switchgear: A. Reyrolle & Co., Ltd. Feed pumps, &c.: Mather & Platt, Ltd. Hand cranes: Herbert Morris, Ltd. Instruments: Electrofio Meters, Ltd. Jib cranes: J. M. Henderson & Co., Ltd. Lifts: Pickerings, Ltd. Lighting installation: Colston Electrical Co., Ltd. Overhead cranes: Stothert & Pitt, Ltd. Soot blowers: Diamond Blower Co. Station cable: W. T. Glover & Co., Ltd. "Vickcen" oil filters: British Separators, Ltd.

Electricity Supply in Palestine.

The Sea of Galilee Reservoir; the River Jordan diverted; Arab Protests.

(From a Correspondent.)

RAPID progress is being made with the great electricity scheme, which is being carried out in accordance with the Rutenburg concession, for supplying electric power to all Palestine.*

The large works in the River Jordan valley are rapidly nearing completion, and it is anticipated that the plant will be working in about one year's time. The whole scheme necessitates the damming of two rivers: the smaller one, the Yarmuck, already flows into a natural basin which makes an excellent reservoir, and it will only be necessary to provide lock gates. The River Jordan is also being made to flow into this basin, and it has been necessary to divert its course for some considerable distance. A concrete-lined canal is being constructed for this purpose, and equipped with gates. When the work is completed the two rivers will flow into the reservoir, and it is estimated that it will contain about 3,000,000 cubic metres of water. The chief engineer told me that in the period of winter rains the whole reservoir could be filled in five or six hours.

Another canal leads from the Yarmuck reservoir to a pressure reservoir, and from the latter large iron pipes conduct the water to the power mill, with a fall of over 80 feet. When this plant is in operation, 30,000 h.p. of electrical energy will be available. At present the requirements of the country are not more than from 10,000 to 12,000 h.p., so that there is ample room for development.

The steel standards which will carry the power transmission lines all over the country are prominent features of the landscape in Palestine, and eventually power will be available for all farms, towns, and villages in any quantity required. The power from the Jordan works will be transmitted first to the station at Haifa, and thence distributed.

In anticipation of this plant eventually reaching its capacity output, a second plan has been prepared. For this the Yarmuck River will be diverted to run directly into the Lake of Galilee; lock gates will block the flow of the River Jordan from the lake, and the level will be raised about 3 feet. This will make available an extra volume of water estimated at 100,000,000 cubic metres. Another power mill of still greater capacity will be built at the Jordan outflow, which will provide sufficient energy to supply all conceivable industrial and agricultural needs in Palestine until the maximum development of the country is reached, so far as it can be estimated at present.

One of the most surprising features of this work is that, though it will be of undoubted benefit to the country, there has been considerable opposition to it by the Arabs. By means of adequate power, land which has lain derelict for 2,000 years or more may now be developed, but in spite of this fact the difficulties are such that it was found necessary in the recent unsettled state of the country, due to religious and political agitation, to quarter a guard of mounted police at the Jordan Valley works.

* ELEC. REV., May 3rd, 1929.

The Leipzig Spring Fair.

A Review of the Electrical Exhibits.

[By Our Special Commissioner.]

(*Concluded from page* 490.)

Industrial Exhibits.

The Industrial Group included approximately 310 exhibitors in all classes of electrical material. The range of machines and apparatus shown was very complete. The greater part of the exhibits was similar to the familiar home shows and did not call for any special comment. There was, however, quite a number of new ideas which are referred to below.

In the switchgear line there was a definite tendency towards the adoption of totally-enclosed ironclad gear as shown by the Felten & Guilleaume Carlswerk A.G., the Bergmann Co., and a number of others. This applied not only to h.p. equipment but also to l.p. distribution panels as shown by a number of manufacturers. None of the units exhibited appeared to present any very novel features, but considerable attention was paid to detail design, more particularly in connection with facility of erection. One other point worthy of mention is the large number of small totally-enclosed ironclad circuit breakers, designed to replace the present cut-out at reasonable prices.

Among the exhibits of more particular interest was that of the Brown Boveri A.G., of Mannheim. On this stand was shown an electric furnace of an entirely new design. The principal characteristic of this furnace is that it is designed in such a way that highly-polished metals, such as copper or bright steel parts, can be heated to any temperature up to 950 deg. C. without losing their polish. This furnace is of the vertical resistance type; the model exhibited is designed for a maximum load of 34 kW. The design is based on the Grunewald patents, and a number of furnaces are in operation of a capacity up to 3 tons and absorbing up to 120 kW.

Another exhibit which, although of little interest for home purposes, is of interest in connection with overseas conditions consisted of a complete system of signalling for open level crossings. Briefly, the system comprises two powerful hooded lamps visible in bright sunshine, showing a red light towards the road approach to the crossing; these lamps are automatically lighted by the train by means of a track contact placed at a given distance from the crossing; the road lamps give a flicker light and are interconnected with similar lamps giving a yellow light, but placed in the line of vision of the train driver. The function of these lamps is to show whether the road lamps are working and should they have failed for any reason, the train driver is warned to exercise increased caution.

The exhibits also included a portable arc-welding machine having a range of 30-180 A and a voltage range of 220-380-500. The machine in itself has no particularly novel feature, and is only mentioned as it constitutes yet another contribution to the alternating current welding field, which with its many advantages is very popular all over the Continent, although it makes headway with difficulty in England.

Special mention should be made of the " Elarc " welding exhibit. Unfortunately this stand was not in the Electrical Section, as would have been expected, and must have suffered on this account. The most interesting and highly educational part of this exhibit was the complete layout of an arc-welded steel building. Samples, sections, and assembled joints were not only shown but were also accompanied by a complete set of mechanical stress diagrams and calculations, power and electrode consumptions, and a complete set of costs not only joint for joint but also for the structure as a whole. Comparative costs with rivets were also shown and provided much food for reflection.

Generally speaking, welding, particularly arc welding, is used to a much greater extent on the Continent than in England, and evidence of this could be seen on practically every stand whether electrical or mechanical. Fabricated assemblies seem to be the rule rather than the exception.

One of the exhibits which attracted a good deal of attention was a Wild-Barfield horizontal furnace (23 in. by 16 in. by 6 in.) of the electro-magnetic type for the heat treatment of steel; the operation of this furnace is based upon the loss of magnetism during treatment. Demonstrations of the furnace at work took place on the stand of the Allegemeine Electricitats Gesellschaft, which manufactures such furnaces under licence from Wild-Barfield Electric Furnaces, Ltd.

British exhibitors in the Electrical Section of the Technical Fair appeared to be the exception rather than the rule. Messrs. Ferranti's exhibit of a comprehensive range of British-made radio components was certainly very refreshing and an outstanding example which surely could be followed by others to the advantage of British industry.

Furnace Temperature Control.

In the industrial measuring instrument line there appeared to be no individual instrument calling for special mention. Several stands, however, were entirely devoted to a complete system of instruments for the scientific control of fuel consumption. Boiler house efficiency seemed to be a leading note, and the tendency appeared to be towards the elimination of the human factor to the greatest possible degree, replacing it by devices based mainly on the use of electrical apparatus. Amongst the specialists in this class, the exhibits of Messrs. Hartmann & Braun and of Messrs. Siemens and Halske were the two outstanding examples. Messrs. Siemens & Halske were also showing a complete board for the automatic electric control of furnace temperatures. The application of electro-pyrometer control to super-heated steam locomotives was another feature of this exhibit, and, although it may not be entirely novel, it provided yet another illustration of the attention that Europe is paying to the matter of fuel conservation in the post-war period.

Electric Motors.

With regard to motors, a fully representative range was to be seen, which when viewed as a whole showed a definite step forward in the standardisation of types. One rather remarkable feature was the apparent absence of single-phase motors of any description. Although it is rather presumptuous to assume that, traction excepted, phase standardisation is now an

accomplished fact, inquiries showed that the Continent as a whole has made considerable headway with the numerous schemes that have been put in hand for bringing the three-phase fifty-cycle supply in as a standard.

One stand entirely devoted to motors of novel design was that of the Himmelwerke A.G. of Tubigen. The exhibit consisted of variable speed motors in which this firm specialises. These motors are of the double-rotor type and can be obtained for vertical or horizontal drive. One of the motors shown was a 5-h.p. vertical motor with drum-type controller. This particular motor has a speed range of 1,500-3,000-4,500-6,000 r.p.m. in both directions; the speed and direction of rotation control is obtained by the simple operation of a single handle.

The variable speed feature was also illustrated in a model specially adapted to certain types of machine tools. In this case the variation of speed is obtained partially by electrical means and partially by means of a cone pulley for belt drive. The outstanding feature of this type is that the motor is mounted in a frame and pivots about an axis in the plane of the feet, the weight of the overhanging motor giving sufficient pull to ensure belt adhesion. A stop is provided to prevent the motor falling in case of belt breakage. Simplification is the key word of this type, which, incidentally, only requires a cone pulley on the driven shaft and a single speed pulley on the motor shaft.

Another very interesting exhibit on this stand was a motor designed in the reverse way to the normal type. These motors are essentially of the belt-driven type and may quite correctly be termed pulley-motors. They are designed with a hollow shaft through which all the leads, both rotor and stator, are passed. The shaft, contrary to the normal type of motor does not revolve but is fixed to anchor brackets. The frame of the motor is circular with disk-type end frames; the outside of the frame may be either of the true cylindrical form or crowned in the same way as a crown pulley. The motor is fixed in position and the belt is passed round the frame itself, which acts as its own pulley. To all intents and purposes it is a hermetically sealed motor, cooled by its own comparatively large revolving surfaces in contact with the air.

A further development of this principle was shown by a motor of this type designed as a five-speed cone pulley. This type obviously gives five speeds on the driven shaft without the necessity of counter shafting. The application of this type of motor to certain tools within its range of horse-power and weight is obvious, and the saving of space, belting, and countershafting is considerable.

This stand and several others exhibited special motors whose overall diameter is reduced to a minimum limit at the expense of total length. One of the special applications of this type was for driving overhanging circular saws, and, if one may judge by the number of manufacturers producing this type, the market must be fairly considerable.

Before leaving the subject of motors it is of interest to note that the Deutsche Luftfilter Baugesellschaft, which specialises in air filters, produces a range of filters specially designed for use with electric motors. In the woodworking machine section several motors fitted with this type of filter were to be seen.

High-Voltage Switchgear.

Although switchgear has been left till last, this section provided perhaps the most striking development to be seen in the Electrical Engineering Section. Space does not allow the description of many exhibits which have one or two interesting points, and we must confine our remarks to the question of extra-high-pressure heavy-duty circuit breakers.

The latter expression appears rather cumbersome for a piece of apparatus which would normally be termed an oil switch. Two firms were exhibiting e.h.p. breakers in which the arc is opened out of oil; in fact the switches do not contain any oil at all. The Allgemeine Electricitats Gesellschaft had in operation two of these switches which may be termed "compressed air switches." The principle upon which this type of switch is designed is that when an arc is struck in air the latter becomes ionised, and in such conditions loses part of its dielectric strength. In order to extinguish the arc the ionised gas must be replaced by non-ionised gas and this is accomplished by admitting compressed air which is fed into the arc chamber as soon as the switch contacts begin to open, the supply being maintained until the dielectric properties of the gap have been restored to their normal condition.

This very brief and highly simplified description of the principle upon which the switch acts is only intended to illustrate the basic idea underlying the design. The problems involved are of a complex nature but have been solved in a sufficiently satisfactory manner to warrant their being produced commercially. There is no doubt that there is a very large field for this type of gear and that the next few years will see a considerable evolution and improvement in design as experience in operation is gained.

At present three-phase compressed air switches are available for up to 100 kV with rupturing capacities up to 1.24 million kVA. The air pressure used is understood to be in the region of 200 lb. per sq. in. At the present time the cost of these switches is approximately 10 per cent. higher than oil switches, but undoubtedly the price will tend to decrease as the type becomes standardised.

Perhaps the most interesting exhibit in the switchgear section was yet another new design of high-voltage circuit breaker, shown by Messrs. Siemens-Schuckert, based on an entirely new and novel principle.

Paradoxical as it may seem, this switch instead of being filled with oil is filled, or rather partially filled, with water.

The type of switch, built for three-phase circuits, is composed of three vertical bakelite cylinders insulated from earth for the normal working voltage. Each cylinder is fitted with a horizontal diaphragm having a hole in the centre and situated at about two-thirds of its height; the cylinders are filled with water to about one half of their height. The stationary contact is placed at the bottom of the cylinder and is permanently covered with water. The moving or top contact, which closes downwards, is situated right out of the cylinder when the switch is in the open position. As the switch closes the moving contact passes down vertically through the central hole in the diaphragm and closes the circuit through the bottom contact. On opening the reverse movement takes place, an arc commences to strike between the contacts, which at the instant of opening are both under water; steam is generated and fills the upper portion of the cylinder with vapour, the pressure of which increases with the duration and the heat content of the arc.

As the top contact moves upwards, passing out through the hole in the diaphragm, the vapour under pressure escapes through the hole and acts in a similar manner to the air in the compressed-air switch. Excess vapour is evacuated by means of a vent in the top of the cylinder. One of the claims made on behalf of this type of switch, known as the water breaker or, alternatively, as the expansion type of breaker is that the vapour does not ionise as readily as air. Furthermore, the pressure is created by the arc itself, which avoids the necessity of using air compressors and their attendant gear.

There are already two schools of thought, the one in favour of the compressed-air type, the other in favour of the expansion type. It will be interesting to watch the results obtained and to ascertain the relative merits of the two newest contributors to the solution of a very old problem.

Numerous other exhibits were to be seen, but no attempt has been made to describe the apparatus on show on the various stands, or to describe the exhibits of any manufacturer. Our intention has been to pick out so far as is possible any apparatus embodying new or novel designs with the object of viewing the progress of electrical engineering in Germany through the perspective of the Leipzig Spring Fair.

Canadian Mineral Resources.

(From our Special Correspondent.)

NO doubt much has been heard in England within the past few years of the great development of the metal mining industry in Canada. Production of gold, silver, nickel, cobalt, zinc, copper and lead has been going up; and even in Manitoba, which has always been considered as one of the purely agricultural provinces of the West, mining is becoming important, the copper-zinc ores of the Flin Flon mine being particularly notable. It will be seen that the above list of metals does not include iron. Now there are in Canada huge iron-ore deposits, especially in Ontario—in the Thunder Bay district, at the western end of Lake Superior; and in the James Bay region in the north, as well as at Sault Ste. Marie, which lies at the eastern end of Lake Superior. The aggregate of the deposits in the last two districts alone is estimated to exceed 300 million tons of ore. Ontario has produced more than 5 million tons of iron ore and concentrates since 1869, but for several years practically all the iron ore fed into the blast furnaces of this country has come from the United States and Newfoundland; about one million tons of iron ore is imported annually, most of it from the former country.

The reason for this condition is not that Canadian iron ore is very low in iron content, but that the ores of Minnesota, whence most of the Canadian imports come, are richer than those commonly used in other countries, and it is cheaper to use imported material.

The Government of Ontario, however, has for some time believed that the day is not very far distant when the ores of Minnesota will not be so readily available, at least not in their present quality. A few years ago, therefore, this Government, anxious to develop the iron ore resources of the province, offered a bounty of one half cent per unit* if the Dominion Government would furnish a like amount, but the latter did not respond, so the plan came to nought.

Last year, the papers announced that a new electric furnace process for the smelting of iron ore had been developed in Canada to a stage at which, it was believed, it would be commercially successful if a bounty were granted. The Premier of Ontario, in view of this new possibility of not only developing iron mining but also of utilising hydro-electric power, has just introduced into the provincial House a Bill which proposes that the Ontario Government shall itself grant the full bounty of one cent per unit. It is hoped that, at various points in Ontario, smelters will arise to produce iron of high quality.

The water-power resources of Ontario are well distributed throughout the Province. It will no doubt be possible to develop some of these at points within comparatively short distances of the iron mines and transmit the power to the mines—thus both mining and smelting could be carried on at one spot, and a good deal could be saved in transportation charges in taking the ore long distances to smelters, and no transportation of large tonnages of coke or other fuel would be required. It is said that tests with the equipment used in the new "Turnbull" process have shown that 60 per cent. "beneficiated" siderite with 40 per cent. "beneficiated" magnetite will produce an excellent basic iron for open-hearth steel making, and that a fine Bessemer steel can be produced by a heavier admixture of siderite. This new process will also produce "sponge" iron, which makes a better grade of steel than pig-iron. Several thousand tons of sponge iron is now imported annually into the United States from Sweden for steel making; in the latter country electric furnaces have been in use for some time for the manufacture of sponge iron.

According to a report of the National Research Council (Canada) on the "Utilisation of the Low-grade Iron Ores of Canada," published in 1924, iron mining in Canada, even at that time, was "not far from being commercially possible," and it was added that "the granting of a bonus for a few years should be a great factor in establishing this much-desired basic industry." It is not anticipated that iron-mining in Canada will itself be a very profitable industry, but the indirect benefit due to increased railway revenues and in other ways would, it is considered, be very great. Among other things, it might well make possible the development of large water powers in certain remote regions at a much earlier date than would otherwise be feasible; any surplus power over and above that required for mining and smelting could be transmitted to rapidly-growing markets in other parts and avert what might, without such available power be a serious power shortage, which could only be supplied by constructing fuel-electric plants. In considering the creation of a new industry, it is interesting to speculate, though by no means easy to estimate, what is the effect of any firm giving employment to, say, 100 workpeople, resulting in the establishment of a community of about 500 persons where none existed before.

These people need houses, good clothing, heat, light, transportation, instruction (religious and secular), medical care, &c. What this means in building materials, food products, textile fabrics, leather, coal, oil, electric power, paper products and printed matter, besides radio equipment, good roads, motor cars, medical and surgical supplies and innumerable other things, can be imagined if one takes the trouble to consider the question.

Coal, or rather lignite, has recently been discovered in some quantity in Northern Ontario—40 to 60 million tons is the present Government estimate of the deposits in the territory which has so far been surveyed, though only in a preliminary manner. Where water-power is so plentiful as in Ontario, the direct bearing on the electricity supply industry of the finding of such relatively low-grade fuel as lignite is not, perhaps, immediately obvious; but the great rate at which the electric power load of the Province is growing and the possibilities of the future in regard to long-distance transmission of gas and oil—such distance having already in some cases far exceeded the transmission distances of electricity†—raise the question as to whether, and how soon, it may be feasible to utilise the lignite, at least indirectly, in the generation of electric power.

In view of the success already obtained in the complete gasification of solid fuels, and their conversion, by hydrogenation, into fuel oils, it would be risky to prophesy that the lignites of Northern Ontario will never affect the electricity supply industry either by serving as a source of energy for that industry or by becoming, in certain directions, one of its competitors.

If nothing else happens, lignites, as a potential source of heat, might well render permanent habitation possible (*i.e.*, winter and summer) in a region where the winter climate is very inhospitable, thus making for the establishment of communities devoted to mining and other industries and making demands for electricity among other commodities.

* "One cent per unit" means one cent per 100 lb. of iron per (long) ton of untreated ore.

† In Germany schemes are in hand for the transmission of (manufactured) gas over distances of 400 or 500 miles. In the United States there is a natural-gas pipe line 750 miles long in use, one of 900 miles under construction, and one of over 1,000 miles being considered; and petroleum has long been piped for hundreds of miles.

Electricity for the Home.

Developments in Domestic Electrification by the Stoke Newington Municipal Electricity Department; News Items.

WE are continually being reminded that progress in electricity supply matters is not the sole preserve of the large undertaking, and an example brought to our notice of the smaller concerns with excellent records in the work of domestic electrification is that of Stoke Newington (borough electrical engineer, Mr. Hedley Large, A.M.I.E.E.). Stoke Newington has a population of 52,000, and the undertaking serves a total of 5,000 consumers. Well over 3,000 of these are domestic consumers using electricity for heating or cooking, or both. Something like 1,500 consumers are being supplied under the assisted wiring scheme in vogue, and it is particularly interesting to note that the scheme is at present responsible for new consumers at the rate of about 60 or 70 per month; indeed, the scheme has developed at such a rate during the past few months that now nearly every street in the borough is cabled. Of the profit of £9,000 made by the undertaking last year, £6,000 was put aside for the purpose of road cabling.

All the wiring work in connection with the undertaking's assisted wiring scheme is carried out by local contractors, the work being thoroughly inspected by the Corporation's representatives. Contracts to the value of between £3,000 and £4,000 are being issued every year, and the results of the free wiring scheme indicate that electricity for cooking and heating is at 1d. per kWh, on a competitive basis with the gas supply at 8d. per therm.

It is interesting to note that from the December quarter last the undertaking abolished all meter rents. Where lighting is supplied at the ordinary flat rate of 4½d. per kWh, 1d. per kWh is charged for supplies for domestic heating and cooking. There is, however, an all-in two-part domestic tariff which is arranged on the basis of 2s. per quarter for each 60-W lamp, or the equivalent, plus 1d. per kWh. Convenience lamps, lavatories, pantries, &c., are not included under this scheme. Under the assisted-wiring scheme for lighting, energy is supplied through prepayment meters at 6½d. per unit, *i.e.*, 4½d. per kWh for lighting and 2d. per kWh for hire and maintenance. Existing or new installations may be purchased for cash or on hire-purchase terms. There is also a demand for penny-in-the-slot meters.

Fig. 2.—The "Creda Bowl" Fire.

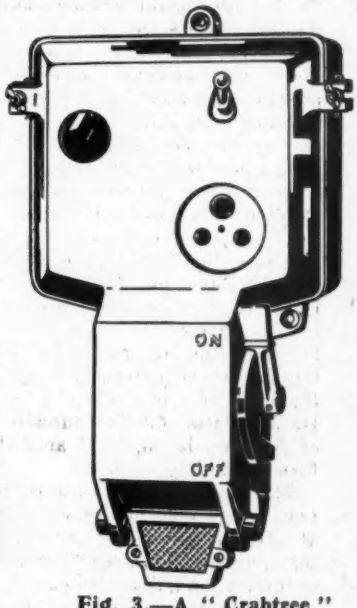

Fig. 3.—A "Crabtree" Cooker Control Unit.

Fig. 1.—The Stoke Newington Showroom.

The undertaking has a small showroom in Edwards Lane, which is kept attractively dressed, fig. 1, and which has resulted in considerable business. There is an average of 450 callers per month to the showroom, and the direct sales are fast increasing without particular selling effort on the part of the undertaking. Sales are not being pushed at present as much as it is intended to push them later on, owing to plant and mains being overloaded.

Manufacturers are invited to demonstrate their wares at intervals, and "shows" by the General Electric Co., Ltd., have resulted in considerable sales of "Magnet" fires. The "Cosyglow" fire of the G.E.C. and the "Cosy" fire of Revo Electric Co., Ltd., have proved to be among the best sellers at Stoke Newing-

ton. The " Creda " " Bowl " fire, fig. 2, of Credenda Conduits Co., Ltd., has attained popularity in the borough. It is loaded at 600 W and has a 12-in. reflector or bowl of hammered copper. The base is of vitreous enamel. The approximate amount of radiator load on the system is 300 kW. Very favourable hire-purchase facilities are offered to consumers for electric fires and other apparatus, but such apparatus is not hired out. This is not the case with cookers, however, which are hired out at 15s. per quarter, including a 3-pint kettle, up to 50 ft. of wiring, and a cooker control unit. This unit, fig. 3, supplied by Messrs. J. A. Crabtree and Co., Ltd., houses in a cast-iron case a main switch and pilot lamp for an electric cooker, together with the necessary accessories, so that portable apparatus, on supplementary circuits, may be conveniently attached. The following is a brief specification of the " Crabtree " unit employed for the Stoke Newington scheme :—25-A d.p. main switch; batten holder for pilot lamp, with ruby window in the case lid; one 15-A tumbler-type switch controlling a 15-A 3-pin plug and socket; two 15-A replacement bridge-type fuses, protecting the pilot lamp and socket sub-circuits. The operating dolly of the tumbler switch projects through a suitable opening in the case lid.

The boiling plates are of the enclosed type, and are arranged with plug-in connections. The first top tray casting provides a suitable unit for the fuses, which are readily accessible by simply raising the hob plate of the cooker. The various elements are governed by 3-heat rotary switches with pointed knobs, and a suitable plug and robust switch are fitted for use with any separate appliance. The " De Luxe " model is finished in grey mottled vitreous enamel, and has a white loose crown plate and door fittings.

A Demonstration All-electric House.

Under the auspices of the Birmingham Electric Circle of the British Electrical Development Association, Inc., a demonstration " all electric " house was opened last week at 32, Court Oak Road, Harborne, fig. 5. It has been equipped by the Circle Committee, of which Mr. R. A. Chattock, late city electrical engineer, Birmingham, is chairman, and contains a complete range of heating, lighting, cooking, and domestic labour-saving electrical appliances—refrigerators, irons, kettles, bed-warmers, coffee percolators, vacuum cleaners, &c. The Committee has adopted a novel means of advertising the house. At the junction of Court Oak Road and an important arterial road a few hundred yards away, a large directional sign, " To Electric House," has been erected. This informs the public that the house is open from 2 till 9 p.m., and that admission is free. The house is being visited by large numbers of people daily, and interest is stimulated by the Birmingham Electric Supply Department's domestic contract tariff, under which current is sold at about one penny per kWh, with a special rate for water heating.

Fig. 4.—A " Davidson " Cooker.

Fig. 5.—Birmingham's Demonstration " All-electric " House.

Two models of cookers are at present handled by the concern, the " Family " model by the Revo Co., and the model by the Creda people. The undertaking carries out its own cooker maintenance work, and so far the costs have been practically nil. The electric iron is, of course, popular everywhere, and a good number of the " Revo " make have been sold by the Stoke Newington electricity department.

It is interesting to note that schemes have been prepared and started for the cabling of every road in the borough, and for the erection of two automatic sub-stations, at a total cost of about £40,000. It is hoped to have the first of the sub-stations running during the coming summer.

A New Cooker.

The " Davidson " cooker, fig. 4, a product of Messrs. Chesterton, Jones & Co., Ltd., Rushey Lane, Tyseley, Birmingham, which was recently displayed at the British Industries Fair, Birmingham, is of a clean robust construction, rendering it particularly suitable for hiring-out schemes. The oven of the large size model has a cooking space of 16 in. by 16 in. by 14 in., with a loading of 2,400 watts. The warming chamber above the oven is fitted with a drop-down door, and provides ample accommodation for warming plates, &c. A large grill is fitted inside this chamber. A feature is the cast-iron vitreous-enamelled tray which supports the grill element and the two boiling plates. This tray makes a very neat finish.

Effects on Revenue of Maintenance of Apparatus.

According to the *Electrical World* one American undertaking has found that an increase in revenue, probably exceeding $4,000 per service man per year, followed the establishment of a consumer's appliance inspection service which periodically examines all appliances in the home and reports upon them. Repairs are made free of charge up to a material cost of $1 per repair. For three years this company has found the plan cumulatively advantageous. About 97 per cent. of the repairs are made on consumers' premises.

Domestic Consumption in U.S.A.

The *Electrical World* states that the electricity sold for domestic purposes by 41 large companies in the U.S.A. increased by 14 per cent. in 1928, as compared with the previous year. The consumption per consumer was 507 kWh, but the ideal aimed at is 7,800 kWh per consumer. The nearest approach to this goal is to be found in the figure of 1,542 kWh per consumer of a Pacific Coast company.

Reviews.

Electricity Supply Transformer Systems and their Operation. By W. T. Taylor, M.Inst.C.E., M.I.E.E. Pp. vi+243; figs. 54. London: C. Griffin & Co., Ltd. Price 20s. net.

A book full of practical experience, investigations, and considered opinions on vexed questions in connection with so essential a part of every electricity distribution as transformers cannot fail to attract the attention of every engineer, mains superintendent, and assistant, excepting only those few who really know all about every detail and have no need to learn more. The best review that can be offered is advice to study the entire text.

That the book makes no attempt to deal with design of transformers is evidenced clearly in its title and in its preface; but it contains much that the designer will do well to ponder over, for practical experience in operation is not always an asset of the designer.

The author limits[1] the indicated oil temperature (*a*) of a self-cooled oil-immersed transformer to 80 deg. C. (*b*) of a water-cooled oil-immersed transformer to 65 deg. C., and the reviewer questions whether that is not unnecessarily conservative, based on the belief that British quality and practice are equal to, if not better than, American, where fifteen degrees more are allowed[2] in each case, presuming that Mr. W. T. Taylor's "indicated oil temperature" and Mr. W. M. Dann's "observable temperature" mean the same. Mr. Dann was reporting[3] the decision of the Transformer Sub-Committee of the American Institute of Electrical Engineers' Machinery Committee, which carries weight.

Mr. Taylor devotes one-eighth of his book to "earthing for protection and safety," and wisely asserts that the safest place on earth is on or as close as possible to the point protected by earthing. Earthing on every consumer's premises is correctly stated[4] to offer the best security and a low, evenly distributed resistance not obtainable in any other way. To connect to earth only at the supply end of a system introduces considerable resistance and impedance varying in amounts with the distance, and at the time a protective earth is most needed it may be open-circuited and therefore not protective.

The chapter on operating troubles deals effectively with every method of connecting-up transformers, the defects that can occur and the best way to maintain the supply when any type of defect develops. The assistant who has fully grasped the details discussed and shown by diagrams will be well prepared for eventualities when he finds himself alone with an unexpected defect in the system he is responsible for maintaining.

The suppression of third-harmonics, also when they cannot appear and when they are to be expected, and the advantages of alternative methods of coupling up are ably handled, but do not lend themselves to abstracting without disadvantage to the reader.

That overhead lines can introduce troubles which must not incorrectly be attributed to the transformer leads the author to include well-considered details of design and of cost of overhead construction, and of poles of concrete reinforced with steel. This type of pole, using British steel and British concrete, is deservedly beginning to receive the attention of those in our Government concerned directly with maintaining and increasing the demands for the services of British workers more than in keeping the imports of foreign grown poles at their present high rates.

It is a book of real merit and will prove of use to a large number of readers.

Direct Currents. By C. E. MAGNUSSON, M.S., Ph.D. Pp. xi+495; figs. 400. London: McGraw-Hill Publishing Co., Ltd. Price 22s. 6d. net.

This volume is a companion to the two already presented to the profession by the author, namely, those on electrical transients and alternating currents, respectively, and we may say that it completes a very excellent trio of studies of the fundamentals of electrical engineering technology. Broadly speaking, the book can be divided into five principal parts which deal with the electric, magnetic and dielectric circuits, the generation of voltage and current and the production of electric power and energy, the dielectric and magnetic fields, the magnetic properties of iron and steel, and the dynamo, including studies of generator and motor characteristics. This accounts for 15 out of the 22 chapters, the remainder of which deal with systems of units, indicating instruments, electrolytic conduction, batteries and electrolysis, transmission and distribution, thermionic and gaseous conduction, and industrial applications.

The volume does not set out to present design details of d.c. machines, but rather the fundamental theories underlying such designs, not only of the finished apparatus, but also of the component parts considered as simpler forms of simple circuits. The treatment adopted by Prof. Magnusson does not call for any advanced mathematical knowledge, and because of this, particularly, we think the volume will appeal widely to the less advanced students, to operating engineers, and to those engineers whose duties are not confined to the study and consideration of any one type of electrical plant.

The volume is completed with an appendix on the treatment for electric shock, which embodies the instructions issued in America by the N.E.L.A. The book is produced in the well-known McGraw-Hill style and represents, we think, extremely good value for money.

Electric Traction. By A. T. DOVER: Second Edition. Pp. xx+719; figs. 510. London: Sir Isaac Pitman & Sons, Ltd. Price 25s. net.

The first edition of this book, which appeared in 1917, early established itself as a standard work on the subject. Since that time the range of railway electrification has widened, although it is still comparatively small, while considerable progress in the art has been made, so that a second edition after 12 years has been demanded. The text has been revised, largely re-written and re-illustrated, and again must take its position in the forefront of railway electrification literature. The book is so well known that a notice of the alterations and additions is all that is necessary. The general plan of the book is retained. In the opening chapters on speed/time curves and energy consumption, a number of new examples are given, but no mention is made of the graphical and "chart" methods of speed/time solution which have made their appearance in recent years. The trolley 'bus has received attention as regards motors, control-gear, and overhead-line equipment, on account of the increasing interest and importance of this vehicle.

In the first edition the author expended much space on various types of single-phase commutator motors, such as the plain, Déri and W.E.L. repulsion machines. All this has now been wisely jettisoned, since the neutralised series motor has established its position in the traction field, and no other commutator machine is now considered for this service. Thus Chapter V has, unlike most of the others, been shortened; it is interesting, however, to note that the new Brown, Boveri motor, devoid of the usual neutralising winding, has been included. Modern designs in polyphase railway motors are arranged with the slip-rings on the motor side of the crank, but these machines are unfortunately not illustrated. The chapter on regenerative braking has been greatly modernised, the purely theoretical methods having been omitted and only practical examples described. Systems of regenerative braking down to standstill (Ernesto Breda and della Riccia) are not mentioned, although they are in use on tramcars in Milan. The descriptive material on locomotives, motor coaches and street vehicles is excellent, and a good section dealing with mercury arc rectifiers is included with "Sub-stations." A number of questions and problems with answers are appended. The typographical work has been well done, and the half-tone blocks are clear. It is, perhaps, a pity that green paper has been mixed in occasionally for tables and pull-out plates. An errata slip is inserted, but here and there errors still remain uncorrected. It must be insisted that these criticisms are directed to a few small points: the book as a whole should, as a reference work, be available to engineers connected with all, except the economic, sides of electric traction; while it will be found indispensable to the student.

The Motorists' Electrical Guide. By A. H. AVERY, A.M.I.E.E. Pp. vii+162; figs. 193. London: Sir Isaac Pitman & Sons, Ltd. Price 3s. 6d. net.

Nowadays the majority of motorists expect their cars, like Charlie's Aunt, to run for ever, and when breakdown occurs they go to the nearest motor service station to have the trouble remedied. Judging, however, from the number of handbooks that are continually being issued, publishers evidently find that there is still a certain section of the motoring public that is desirous of knowing the why and wherefore of the components of their cars, realising that it frequently means a lower bill for repairs if they themselves are able to diagnose the cause of any trouble—as was the reviewer's experience one day last summer—and so only occupy the expert repairer's actual time in providing and fixing a replacement for the faulty part, or, by means of his special tools, in carrying out any necessary adjustments.

Agreeing then that there is still a demand for books of this kind, Mr. Avery's little work is one that may be recommended, in that, dealing as it does with the increasingly popular form of battery and distributor ignition, as well as with magnetos, and also even with electrically-operated screen wipers, it may be described as thoroughly up-to-date. The elementary principles of magnetism and electricity are dealt with in the first three chapters, which are well illustrated with explanatory diagrams. The remaining chapters contain much practical information, explaining the action of and how to maintain accumulators, magnetos, lighting dynamos, engine starting motors, and all other electrical devices found on up-to-date motor vehicles. Many useful details are given with regard to lamp bulbs for motor vehicles, but we are not sure that these are in accord with the provisional standards adopted by the Electric Lamp Manufacturers' Association of Great Britain, in conjunction with the Society of Motor Manufacturers and Traders. A full glossary of electrical terms is given at the end of the book, and included in it is a page illustrating the conventional symbols used in electrical circuit diagrams.

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[1] Line 24, p. 152.
[2] "Operating Transformers by Temperature" by W. M. Dann, F.A.I.E.E., Winter Convention of American I.E.E, New York, January 27th, 1930.
[3] *Journal* A.I.E.E., January, 1930, p. 3.
[4] *Ibid.*, p. 177.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

The Canadian Tariff.

Reuter (Ottawa) says that Mr. Dunning, the Canadian Finance Minister, will probably make his annual Budget speech in the Commons during the last week of March, when he will announce the tariff changes and taxation reductions and will generally review the position of Canadian trade and the Federal fiscal situation. The year's surplus will be about $60,000,000. It is believed that the main feature of the tariff changes will be in the direction of increasing the Imperial preferential tariff over a wide list, particularly on commodities imported from the United Kingdom in which the United States is now the chief competitor for Canadian trade. It is probable that the Minister will announce the continuation of the rigid enforcement of the provision requiring 50 per cent. Empire labour and material in order to qualify for entry under the preferential tariff. The Federal Tariff Advisory Board has been working for the past two years on the thorough revision of the tariff schedules, and the Budget is likely to involve the most far-reaching tariff changes of the past few years.

The Industrial Welfare Society.

A conference is to be held at the Hotel Victoria, W.C.2, to-day (Friday) under the auspices of the Industrial Welfare Society on "Employment Management." Mr. A. P. Young, O.B.E., manager of the Rugby works of the British Thomson-Houston Co., Ltd., will deal with "The Employment Department." Sir Harold Morris, K.C., president of the Industrial Court, will speak at the luncheon, and in the afternoon Mr. Percy A. Best (James Shoolbred & Co., Ltd.) will present a paper on "Staff Management."

Women in Industry.

The Home Office has prepared a memorandum entitled "A study of the factors which have operated in the past and those which are operating now to determine the distribution of women in industry." (Cmd. 3508, Stationery Office, 9d. net). In the introduction to this it is explained that the study has been made primarily to ascertain whether the restrictions which have been placed on the employment of women has proved a handicap to them. The Open Door Council and certain women's societies have maintained that these restrictions have been a hindrance to the employment of women, and also that they have tended to drive women into the least skilled and worst paid jobs. On the other hand, organisations representing the industrial women themselves have opposed the removal of the restrictions. Briefly, the latter relate to hours and times of employment, and there are also safety and health provisions specially laid down for female workers. The Department's survey does not cover the whole of industry, but is confined to a number of branches which are considered typical. For these branches the relative percentages of men and women employed are given for the years 1890, 1895, 1907 and 1928. In practically every case there has been an increase during the period in the proportion of women workers, but it is noteworthy that the war was not responsible for a large permanent increase in the female element. The growth is considered to be due to other causes, one of which is undoubtedly the increased use of labour-saving machinery. In the case of the clothing industry in which two-thirds of the employés are women, it is shown that the introduction of electrically-driven knives has enabled women to become cutters, while the general utilisation of electric power has converted the clothing business from a handicraft to a factory industry. In electrical fittings and wireless and scientific apparatus production women are employed on light repetition work. But the heavier and dirtier work is generally done by men, and this is also the case where skill, only to be acquired by long training, is needed, particularly in the scientific apparatus industry. The conclusion is reached that except in a few isolated cases there is little evidence that restrictions have handicapped women in the past or are handicapping them now. "The only complaint that has reached the Home Office in recent years has been that the prohibition of night employment has prevented women who have been trained as electricians from taking charge of some small country stations."•

The tendency to find women mainly engaged in unskilled processes is attributed to the fact that the industrial life of women is a short one. On this account they are unwilling to spend much time on a course of training; they seek to earn a good wage as quickly as possible. One of the two appendices to the report shows the percentages of men and women workers in various classes of industry according to age groups. Under "electrical apparatus makers" the total numbers of men and women employed are given as 143,795 and 20,404, respectively. 94 per cent. of the women and 66 per cent. of the men are under the age of 35. The proportions of youths and girls under 18 are 23 and 12 per cent., respectively.

• In the course of a letter to *The Times* (March 13th), Lady Moir, president of the Women's Engineering Society, and Miss Caroline Haslett, hon. secretary, quote this paragraph and say:—"On this matter we, of the Women's Engineering Society, are finding much difficulty in arranging with parents for girls to enter the electrical industry as apprentices, because girls so trained will find it impossible to take their proper place in connection with power development schemes unless the Home Secretary can overcome this difficulty when fresh legislation is before the House of Commons. Girls can be trained and can work in any department of the electrical industry, but their progress is hindered because of their inability to work in the power station or the laboratory workshop during the night period. With rural electrification as a practical issue before the country and the inevitable growth of the small country power station, this matter is a very serious handicap on the possible contribution women can make to the solution of that great and pressing problem."

The ex-British Westinghouse Reunion.

At the twelfth annual reunion of the ex-British Westinghouse Association, held on March 17th at the Hotel Cecil, London, Mr. J. S. Peck presided over a record attendance, exceeding 150 members. The proceedings followed the usual informal lines, the members being at separate round tables seating ten. In a humorous speech, Mr. P. A. Sanders proposed the toast of "The Association." His remarks also had a serious side, and he specially paid tribute to the engineering genius of the late George Westinghouse. Mr. J. S. Peck, replying, was also reminiscent of the early "nineteen hundreds," and he paid a tribute to H. S. Loud, who was then in charge at Trafford Park. Mr. E. M. Herr, of the Westinghouse Electric and Manufacturing Co., Pittsburgh, who was returning to America from a world tour, and Mr. J. Snow Huddlestone, representing the newly-formed Association of ex-Siemens Men, were welcomed as guests and both extended greetings from their respective interests. The toasts to "Absent Friends" and "The Silent Toast" were given at 10 o'clock, and with the latter were coupled the names of "ex-B.W." men who had died during the past year, Messrs. Dunkley, Bradshaw, Toplis, and Loud, and Lieut.-Col. Cradock.

Information Regarding Chile.

We have received from the Chilean Ministry of External Relations a booklet (20 pp.) which contains a great deal of information about Chile, in a small compass. Physical and climatic features, government, transport, finance, education, communications, mineral and agricultural productoin, manufacturing, &c., are succinctly dealt with, and the publication should prove a useful means of bringing the salient features of the Republic before British traders.

Ruston & Hornsby in France.

A private company has been formed by Messrs. Ruston and Hornsby, Ltd., Lincoln, under the title of Société Anonyme des Moteurs Ruston-Hornsby, 5, Avenue de la Republique, Paris, to exploit their oil engine business in France and the French Colonies.

Unemployment.

An increase of 7,935 in the number of registered unemployed was recorded during the week ended March 3rd. On that date the total was 1,547,200, as compared with 1,539,265 on February 24th, and 1,387,332 on March 4th, 1929. It is estimated that on February 24th there were approximately 9,941,400 insured persons aged 16 to 64 in employment, which was 57,300 fewer than a month before, and 17,300 fewer than a year before.

Social Events.

At the Cripplegate Theatre, E.C., on Friday last week, the Henley Dramatic Club gave an excellent presentation of *Rookery Nook*, a three-act farce by Ben Travers. This type of stage piece is not of the easiest for amateurs and is likely to fall flat if the rapid action is not sustained and the dialogue kept going. All fears on this score were allayed by the brilliant performance of Mr. A. V. Burnett as Gerald Popkiss. He was never at a loss and was very ably supported by Mr. R. K. Edney (Clive Popkiss) and the rest of the company. Miss Kathleen Hayward as Rhoda Marley was perhaps a little too ingenuous and Miss Dorothy Josling played an "unsympathetic" *rôle* (Gertrude Twine) a trifle stiffly. The incredible innocence of Mr. F. J. Batten as Harold Twine was well sustained, while the Teutonic accent of Mr. Hugh Stanley (Putz) was admirable. Mr. Frank Bettley's choleric Admiral Juddy was a good study of "language" kept within bounds with difficulty. Miss Elsie Savage's virtuous indignation as Mrs. Leverett, and Miss Kitty Thurgood's acting as Poppy Dickey, an *enfant terrible*, also reached a high standard. Miss Fay Smith (Clara Popkiss) showed appropriate hope and doubt alternately as Gerald's wife. Miss Netta Taylor made a brief appearance as Mrs. Possett. The prompter had nothing to do, which was as it should be. During the intervals musical selections were given by Art Gilbert and his band. The producer (Mr. Henry Thornton) and the stage manager (Mr. R. H. Edmead) did their work well and altogether the show was first-rate.

On Friday last week the staff of Messrs. Baxter & Caunter, Ltd., held their first annual dinner at Pinoli's Restaurant, Wardour Street, W. The chair was occupied by Mr. E. A. Boxall, who proposed the health of the guests. This was responded to by Mr. A. Baxter and Mr. A. G. Mortimer, directors of the company. After dinner an excellent musical programme was given by members of the staff.

A successful dance arranged by the staff of the Cardiff branch of the Edison Swan Electric Co., Ltd., was held on March 10th at the Palais de Dance, Newport Road, Cardiff. The event was well supported by nearly 200 members and friends of the staff, and an enjoyable function was concluded in the early hours of the morning.

A Novel Service Scheme.

A service scheme has been initiated by Walker Bros., Quality House, Temple Street, Birmingham, for domestic users of electricity. Essential features of the scheme are as follows: For a small annual fee an expert electrician will call at subscribers' residences three times per annum with the necessary testing instruments, and will test the electrical installation for leakages; examine the installation for defects; make any adjustments, and do any repairs to lights or bells which do not make the total time spent more than one hour per visit; discuss with and advise the subscriber regarding any electrical difficulty or proposed scheme of electrification. Material supplied is charged for at the normal rates.

German Lamp Production.

According to the *E.T.Z.* the production of electric incandescent lamps in Germany during 1928 amounted to 98,900,000, as compared with 93,970,000 in 1928. Of the total, 33,450,000 were exported, while during the year 5,140,000 foreign electric lamps were imported into Germany.

Electrical Goods for the British West Indies.

H.M. Trade Commissioner in the British West Indies reports that a local company is desirous of getting into touch with British manufacturers of electric washing appliances, such as clothes washing, drying and ironing machines, and also with manufacturers of line material, such as pole fittings, galvanised iron bolts, brace and insulators for wooden pole work. Companies desirous of offering appliances and fittings of British manufacture can obtain further particulars upon application to the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1. Reference No. A.X. 9284 should be quoted.

The Automobile Electrical Association.

Arrangements have been made for the names of members of the Automobile Electrical Association to be entered in the new edition of the Register of the Motor Trade which is now in process of revision by the Society of Motor Manufacturers and Traders, Ltd. A badge of membership has been designed and blocks are available for use in notepaper headings.

New French Company.

L'Union pour l'Industrie et l'Electricité is the name of a concern which has been formed in Paris (23, Rue de Balzac) with a capital of 100 million francs to establish electric power stations. Several well-known French electrical concerns are interested in the new undertaking.

Laying Cables across an Irish Lough.

A contract for laying 33,000-V cables under water has just been completed by W. T. Henley's Telegraph Works Co., Ltd., for the Antrim Electricity Supply Co. This comprised the installation of seven lengths of 0.15 sq. in. 33-kV single, paper-insulated, lead-covered, non-magnetic wire-armoured cable, each length being 1,400 yards and weighing nearly 13 tons, across the bed of Larne Lough. The barge was specially converted for the purpose and was loaded with the cables at Belfast, being towed round to Larne on Saturday, March 1st. The installation began at the step-up 33,000/6,600-V substation 100 yds. north of the generating station. Three motor boats took the cable barge in tow to a point as near the shore as possible, when a winch on shore was substituted for the motor boats. The seven lengths of cable were laid across the lough in one tide—about five hours—and the supplemental work of hauling the shore ends into their final position occupied the rest of the day. The accompanying illustrations show the work in progress. The main contractors for the scheme are Messrs. Henry Boot & Sons, Ltd., Sheffield.

Laying 33,000-V "Henley" Cables across Larne Lough.

Book Notices.

"The Marconi Licence." Pp. xii+9. London: Trader Publishing Co., Ltd. Price 6d. post free. This reprint explains in simple terms the benefits of the nineteen major patents involved. It is written by a leading patent authority who has been long connected with the radio trade, and should be a useful guide for manufacturers who wish to produce receivers, and gives essential information to those whose business includes the re-sale of manufactured instruments and who may be as liable as the manufacturers themselves in any action for infringement.

"Reid's Handy Colliery Guide for Northumberland, Durham, Yorkshire, Cumberland, and Westmorland, for 1930." Newcastle-upon-Tyne: A. Reid & Co., Ltd. Price 2s. 6d.—This useful publication has been carefully revised from the latest official returns and other sources. A colliery map giving the position of collieries as well as the railways and stations for Northumberland, Durham, and Yorkshire, is included, as well as the Coal Mines Act, 1911, with various statutory rules and orders issued since the Act came into force.

"Aluminium Foundry Data." Pp. 54; illustrated. Published by the British Aluminium Co., Ltd.

"Publication of the International Labour Office (League of Nations)." Studies and Reports, Series F, Second Section (Safety) No. 4, Protection of Workers Operating Metal-working Presses. London: P. S. King & Son, Ltd. Price 5s.

"The Electric Wiring of Buildings," by F. C. Raphael. Pp. x+258; figs. 154. London: Sir Isaac Pitman & Sons. Price 10s. 6d. net.

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"*Journal* of the Institution of Electrical Engineers." Vol. LXVIII. March, 1930. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

"The *Journal* of the Engineering Society of the University of Liverpool." Vol. VII, February, 1930. Published by the University Press of Liverpool. Price 1s.

"Electrotechnics, No. 4," February, 1930. This publication of the Electrical Engineering Society of the Indian Institute of Science, Bangalore, S. India, contains about 20 articles covering a comprehensive range of subjects, including "Economic Aspects of the British Grid," "High Voltage Insulation," and "Short-Wave Wavemeter Calibration." Price Rs. 2.

"Safety Pamphlet No. 6 of the Mines Department."—"The use of Chains and other Gear for Hauling and Lifting." H.M. Stationery Office. Price 6d. net.

The spring number of *Speed*, the journal of the Edinburgh Corporation Transport Department, contains many interesting articles and stories in addition to reports of the Department's many social activities.

The 1930 catalogue of the lending library of the Institution of Electrical Engineers is now available and copies can be obtained by members on application to the secretary.

"London and the Home Counties Electricity District.—Statement of charges made for lighting, power, heating and cooking supplies by electricity supply undertakings in the district as at January 1st, 1930." Published by the London and Home Counties Joint Electricity Authority.

"Design of Electrical Apparatus," by J. H. Kuhlmann. Pp. XII+455; figs. 246. London: Chapman & Hall, Ltd. Price 30s. net.

"Principles of Electrical Engineering," by W. H. Timbie and V. Bush. Second edition. Pp. VII+595; figs. 270. London: Chapman & Hall, Ltd. Price 22s. 6d. net.

The "Silver Bullet."

The "Silver Bullet" racing car on which Mr. Kaye Don is to attempt to break the world's record, was produced by the Sunbeam Motor Co., Ltd., and is fitted with high-tension ignition wire supplied by Messrs. Callender's Cable & Construction Co., Ltd.

An Argentine Electrical Concession.

The *Review of the River Plate* (February 7th) reports that the Deliberative Council of Lobos (Province of Buenos Aires) has decided to invite offers for the service of electric light and power for a period either of ten or twenty years. Tenders were to be presented within ninety days.

Electricity v. Gas at Monmouth.

In our last issue we reported that the Monmouth Gas and Water Co. was objecting to a clause in the agreement by which the Corporation is transferring its electricity undertaking to the Monmouth Electricity Co., Ltd. By this the Corporation undertakes to use, and encourge the use of, electricity wherever possible. The matter was raised at last week's Council meeting, when a member said that the Council should not take sides, especially as the Gas and Water Co. was a large ratepayer. The chairman of the Electric Light Committee said that they had done their best for the general body of the ratepayers.

New Catalogues and Lists.

Small Electric Motors, Ltd., Eagle Works, Church Fields Road, Beckenham.—Illustrated leaflet No. 21, describing "Semoco" portable lighting sets.

Victoria Electric Plant Co., Ltd., Spencer Street, Victoria Street, S.W.1.—An illustrated folder describing Siemens-Schuckert outdoor lighting fittings, for which the company is the sole London and southern agent.

British Thomson-Houston Co., Ltd., Rugby.—Descriptive list No. 2,535, and price lists Nos. 7201—E, sections 1 and 2, 5116—B, and 5345, dealing, respectively, with high speed helical gearing, fractional h.p. motors, a.c. oil-immersed rotor starters, and a.c. motor control pedestals.

Siemens Electric Lamps & Supplies, Ltd., 38 and 39, Upper Thames Street, E.C.4.—A comprehensive catalogue (pp. 43) of "Beniamin" reflector fittings and lighting specialities. Illustrated and priced.

Mr. Harold Ashton, Bull's Head Chambers, Market Place, Manchester.—A circular drawing attention to the "Ashton" flexible protector and electric lamp saver.

Oswald Record & Co., 17, Victoria Street, S.W.1.—List No. 30 drawing attention to the "Osrecco" pocket Wheatstone bridge and combined insulation testing set and portable voltmeter or volt-ammeter. Illustrated and priced.

Electro-Dynamic Construction Co., Ltd., 733b, Old Kent Road, S.E.15.—An illustrated and priced leaflet dealing with the company's d.c. and a.c. rotary transformers for wireless amplifiers and gramophones.

New Distributors of Edison Storage Batteries, Ltd., Victoria House, Southampton Row, W.C.1.—A well-produced brochure (pp. 40) describing in detail the Edison steel-alkaline battery and outlining its many applications to commerce and industry, which include street trucks, industrial locomotives, train lighting, storage battery cars, &c. A number of excellent illustrations show the varied industrial uses of these batteries.

Messrs. A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—A comprehensive catalogue for 1930 of the company's electrical accessories, including fuse gear, air and oil break switches, plugs and sockets, heating apparatus, &c. Reference to the various sections is facilitated by a thumb index, and the publication is fully illustrated and priced.

National Accumulator Co., Ltd., 93, Great Portland Street, W.1.—A brochure giving details of the amalgamation of Messrs. Peto & Radford and the Hart Accumulator Co., Ltd. The cover has a striking design, after the modern school, in blue and black.

Messrs. W. Canning & Co., Ltd., Great Hampton Street, Birmingham.—An illustrated folder showing the many applications of the company's chrome plating process.

Messrs. Crompton Parkinson, Ltd., Guiseley, Leeds.—An illustrated pamphlet containing descriptive particulars of d.c. switchboards.

Messrs. E. K. Cole, Ltd., "Ekco" Works, London Road, Leigh-on-Sea.—A fully illustrated and descriptive catalogue for 1930 of "Ekco-Lectric" radio receivers and power supply units. Priced.

A.E.G. Electric Co., Ltd., 131, Victoria Street, S.W.1.—A stock list for March of a.c. and d.c. motors, "Furniculus" fires, domestic appliances, cables, meters, &c.

Messrs. Gent & Co., Ltd., Faraday Works, Leicester.—Two illustrated catalogues, Book No. 1, Section 1b, and Book 7, Section 2b, dealing, respectively, with electric bells, indicators, pushes and contacts, and "Tangent" electro-motor syrens.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—A stock list for March of a.c. and d.c. motors, transformers, &c.

Brookhirst Switchgear, Ltd., Northgate Works, Chester.—An illustrated brochure dealing with the company's voltage regulators for tapped transformers.

Trade Announcements.

Mr. William Cogger, electrical engineer, 11, Earl Street, Maidstone, has removed his business to Rose Yard, High Street.

Mr. Bernard L. Myer, A.M.I.E.E., has opened an office and showroom at 23, Water Street, Liverpool, where he will represent Messrs. Chesterton, Jones & Co., Ltd., Tyseley, Birmingham, for "Davidson" electric heating appliances for Lancashire, Cheshire, North Wales, and Isle of Man. He will continue to represent the Power Centre Co., Ltd.

The address of the Chester branch (Sales Department) of Callender's Cable & Construction Co., Ltd., is now St. John's House, Little St. John Street, Chester.

New branch premises have been opened by Superlamp, Ltd., at 23, Kensington Park Road, W.11 (telephone No.: Park 2332).

European Electrical Negotiations.

A German correspondent of *The Times Trade and Engineering Supplement* reports that the principal German manufacturers of electrical machinery and apparatus are negotiating with the chief Austrian, Czecho-Slovakian and Hungarian concerns with a view to concluding an agreement for mutual protection of markets and uniformity of export prices. The great variety of the products concerned, however, is a substantial obstacle in the way of any such arrangement.

Recent Contracts.

The Birmingham Corporation has placed a contract with the English Electric Co., Ltd., for 40 double-deck, top-covered bus bodies. They will be mounted on A.E.C. "Regent" chassis to seat 58 passengers, and will have safety glass throughout and stainless steel fittings. The value of the contract is £33,000. The English Electric Co. has also received an order from the Newcastle Corporation for three double-deck, top-covered bus bodies, each seating 50 passengers. The seats in the upper and lower saloons will be upholstered in moquette. The bodies will be made for mounting on A.E.C. "Regent" chassis.

For Sale.

Messrs. Howard & Bullough, Ltd., Globe Works, Accrington, have for disposal a number of motors, ohmmeters, ammeters, voltmeters, and other electrical material. Messrs. Leopold Farmer & Sons will sell by auction on the premises on April 8th freehold and leasehold manufacturing premises, stock of spare parts, &c., at Thames Ditton. Accrington Corporation Electricity Department invites tenders for a quantity of d.c. 230-V second-hand meters. Lancaster Corporation Electricity Department has for sale two 150-kW rotary convertors, each complete with transformer, e.h.p. draw-out truck type switchgear, &c. (See our advertisement pages to-day.)

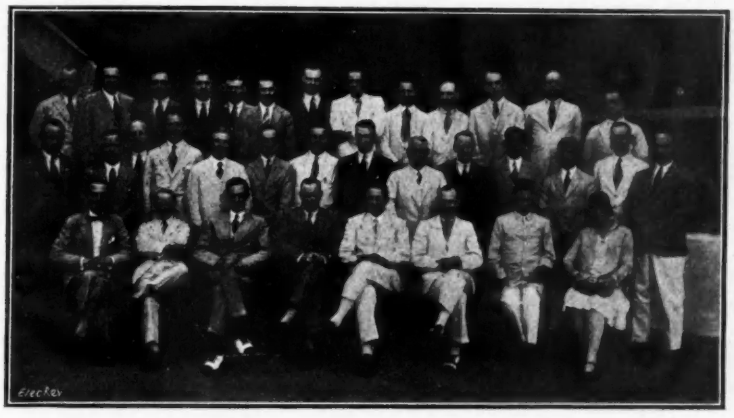
Indian Electrical Development: An Important Conference.

A conference of representatives of the following electricity supply companies and transportation undertakings throughout India and Burma was recently held in the offices of the Bombay Electric Supply and Tramways Co., Ltd., Bombay:—Ahmedabad Electricity Co., Ltd.; Andhra Valley Power Supply Co., Ltd.; Bhagalpur Electric Supply Co., Ltd.; Bombay Electric Supply and Tramways Co., Ltd.; Bombay Suburban Electric Supply, Ltd.; Burma Electric Supply Co., Ltd.; Calcutta Electric Supply Corporation, Ltd.; Calcutta Tramways Co., Ltd.; Cawnpore Electric Supply Corporation, Ltd.; Dacca Electric Supply Co., Ltd.; Delhi Electric Supply and Traction Co., Ltd.; Karachi Electric Supply Corporation, Ltd.; Kundley Power Co., Ltd.; Mozufferpore Electric Supply Co., Ltd.;

Patna Electric Supply Co., Ltd.; Rangoon Electric Tramways and Supply Co., Ltd.; Shahjahanpur Electric Supply Co., Ltd.; Surat Electricity Co., Ltd.; Tata Hydro-Electric Power Supply Co., Ltd.; Tata Hydro Agents; and Tata Power Co., Ltd.

Mr. C. N. Moberly, C.I.E., general manager of the Bombay E.S. & T. Co., Ltd., was voted to the chair, and a representative of the Electrical Development Association attended throughout. The objective pursued in the papers and discussions was how to increase the use of electrical energy in India and to improve transportation for the general benefit of the community. The programme therefore opened with a general paper on "Progress." In this it was maintained that progress depended on an active sales policy, with intimate contact with the consumer, because every other activity hinged on this—costs, tariffs, service, and publicity. There was general agreement on the principle that the best "selling force" was the satisfied consumer, and that every effort should be made to ensure that the consumer should be given full value for his money, at rates suited to his requirements and with the best service which could be given. From this the conference turned to publicity, and figures were given showing the remarkable manner in which the Indian demand had responded to an active sales policy backed by systematic publicity. Attention was also drawn to the results which had flowed from co-operative advertising in Great Britain, instances being the propaganda of the Gas Association, the Electrical Development Association, and the work of the Empire Marketing Board. In India there was a parallel in the effective publicity of the Indian State Railways. It was agreed that similar results might be expected from a co-operative advertising campaign conducted by the electricity supply companies in India, and the subject was remitted to the executive further to explore the ground. Associated with these activities was the question of assisted purchase and the hire of domestic electrical apparatus, the rapid growth of the use of electric refrigerators being cited as an example, and the unanimous decision was reached that assisted purchase and hire were closely linked with a selling campaign. From this the conference turned to the more technical question of the type of domestic electrical apparatus available. It was shown that whilst many standard articles were well suited to Indian conditions, and were giving good service, in certain directions they were not well adapted to Indian circumstances. This was specially marked in the use of electricity for cooking in Indian households, and it was agreed that the supply companies should pool their knowledge on this subject, experiment in the evolution of special apparatus to meet Indian requirements, and then market successful patterns in co-operation with the manufacturers of electrical goods. Special stress was laid on the desirability of encouraging the use of sound electrical apparatus, as cheap and inferior articles never gave good service.

The field of transportation was examined from several standpoints. There was a most interesting discussion on the tramcars of the future, illustrated by a model of a high capacity, double-decked tramcar, with a low platform for exit and entrance, central doors opened and closed by power, and enclosed vestibules for the conductor and driver. The discussion revealed a difference of opinion between traffic experts as to the respective advantages of the double-decked car, and the single-decked with or without a trailer, and the conclusion was that each transportation agency must work out the most suitable unit in relation to its local conditions. There was a specially interesting discussion on the "rationalisation" of transport, involving the elimination of unnecessary duplication, the needs of the community being the means of deciding whether competition was desirable or necessary. The conference unanimously endorsed a proposal pressing for the establishment of traffic authorities in India, representing the local authorities, the traffic police, the transportation agencies of every character, and the pedestrian. During the week visits were paid to many places of special interest to electrical engineers and transportation officers, including one to the receiving station of the Hydro Companies at Dharavi and the power station of the G.I.P. Railway at Chola.



An Indian Electrical Development and Transport Conference.

Bankruptcy Proceedings.

L. J. COLLER (trading as J. & F. Coller), 63, Heston Road, Leicester, electrical engineer.—The first meeting of creditors in this matter was held on March 11th at the Official Receiver's office, 1, Berridge Street, Leicester, when a statement of affairs was submitted showing liabilities of £149 against net assets of £124. The debtor attributed his failure to lack of capital, the slump in house-building since the subsidy was discontinued four months ago, and competition. Prior to the death of his father in April, 1927, he assisted the latter in a small electrical wiring business in Leicester. He then took over the business on his own account, and about six months later extended it so as to include the sale of electrical fittings, cycle accessories and wireless components. The sale of goods in the shop had never been successful, but the electrical wiring contracts kept him fairly busy until about four months ago, when the housing subsidy was removed. Since that time he had had little or no work. He had only kept a day book containing particulars of wiring contracts. He stated that he became aware of his position in October last. In an endeavour to increase his turnover he recently bought for cash a small stock of hardware, but he had been unable to sell the goods at a sufficient profit. The case was left in the hands of the Official Receiver as trustee.

E. H. NEWMAN and M. BAYNES, trading as Langham Radio, wireless manufacturers, 96, Regent Street, W.—A further sitting of the London Bankruptcy Court was held on March 7th before Mr. Registrar Mellor for the public examination of these debtors. Particulars of the failure appeared in our last issue. The accounts showed liabilities of £11,143 and assets nil. The debtor Newman, in reply to the Official Receiver, stated that a previous failure was recorded against him in December, 1925, after he had carried on business in partnership. He had not yet obtained a discharge from those proceedings. He did not agree that any discussion took place regarding a partnership with the debtor Baynes, and he denied that he had registered a company in France without Baynes's knowledge or consent. A number of the customers had given credit to the firm knowing that he was an undischarged bankrupt. He did not agree that there were substantial inaccuracies in the books of account. The examination was further adjourned until April 11th.

MARGARET K. CLEMENTS (trading as K. Raymond), wireless apparatus dealer, 27 and 28a, Lisle Street, Leicester Square, W.C.—The receiving order in this case was made by consent at the London Bankruptcy Court on February 27th upon the petition of V. Zeitlin & Sons, Ltd., and the first meeting of creditors was held on March 13th. The debtor attributed her insolvency to the serious loss occasioned by a fire, to heavy expenses incidental to ill-health, to general depression in trade, to severe competition, and to extensive advertising expenditure. The debtor has lodged accounts showing total liabilities of £5,470 (unsecured £5,514) and net assets expected to realise £1,030. A resolution was passed for Mr. S. C. Crimes, 150, Southampton Row, W.C., to act as trustee and administer the estate in bankruptcy.

J. L. GOLDMAN, radio engineer, 100, High Holborn, and formerly of 4, Great Queen Street, W.C.2.—The public examination of this debtor was held on March 13th before Mr. Registrar Warmington at the London Bankruptcy Court. The receiving order was made last January on the debtor's own petition. He returns liabilities of £1,669 and assets valued at £429. The debtor attributed his insolvency to lack of capital, to depression in trade, to gross profits having been insufficient to meet overhead charges, and to loss sustained and moneys expended in connection with the perfecting and manufacture of radio sets, &c. The examination was concluded.

D. W. MORPHY, wireless apparatus manufacturer, lately of 4-5, Dorset Mews North, Upper Gloucester Place, N.W.—The public examination of this debtor was held on March 7th before Mr. Registrar Mellor at the London Bankruptcy Court. The accounts showed liabilities of £3,803 against assets valued at £419. He attributed his insolvency to lack of capital and to adverse trading conditions. The examination was concluded.

F. G. WHEELER, "Wynchwood," Broadlands Avenue, Shepperton-on-Thames. Trustee, Mr. T. Gourlay, Official Receiver, 29, Russell Square, W.C., released February 28th, 1930.

S. E. HUNT, electrical engineer and contractor, 8a, Torwood Street, Torquay.—First and final dividend of 1½d. in the £, payable March 26th, at 4, Charterhouse Square, E.C.

J. LITTLER, electrical and radio engineer, 9, Hoghton Street, Southport.—Second and final dividend of 8d. in the £, payable at the offices of the trustee, Mr. A. T. Eaves, 47, Mosley Street, Manchester.

Company Liquidations.

Staffordshire Electrical Accessories Co., Ltd., Hanley.—At a meeting of creditors on March 11th a statement of affairs was presented showing £1,262 due to unsecured creditors and net assets of £923. Debentures for £1,462 have been issued, and consequently there is an estimated deficiency of £539 so far as the debenture holders are concerned. The appointment of Mr. D. H. Bates, 10, Cheapside, Hanley, as liquidator was confirmed.

Standard Platinum Contacts, Ltd., 121-123, Shaftesbury Avenue, W.C., and Holden Road, Finchley.—Under the compulsory liquidation the Official Receiver has issued a statement of affairs showing liabilities of £2,774 against assets of £611, leaving a deficiency of £5,661 with regard to contributories, the issued capital consisting of 3,499 ordinary shares of £1 each. He states that a small dividend will eventually be paid.

Almondsbury & District Electric Supply Co., Ltd.—A meeting of creditors was called for March 20th at the offices of Messrs. F. J. Acland & Co., Sun Buildings, 1, Clare Street, Bristol. (This notice is purely formal. All trade creditors have been or will be paid in full, the liquidation being in consequence of the sale of the company's assets and undertaking.)

Charters Electric Supplies Co., Ltd.—A meeting of members is called for April 11th at the offices of Messrs. Bennett and Bennett, Market Gate Chambers, Warrington, to hear an account of the winding up from the liquidator, Mr. J. W. Watchurst.

Telephone Bureau, Ltd.—A meeting of creditors was held on March 19th at the offices of Messrs. A. Laban, Sons & Co., 25-27, Oxford Street, W.

Burgoyne Wireless Co., Ltd.—Winding up voluntarily. Liquidator, Mr. J. J. Baker, Eldon Street House, Eldon Street, E.C.

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price Mar. 18th.	Fortnight's inc. or dec.
a	Acid, Oxalic ... ... per lb.	5¾d.	...
a	Ammoniac, Sal ... ... per ton	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£25	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... ... per lb.	8d. to 4d.	...
a	,, Perchlorate ... ... ,,	5¾d.	...
a	Shellac ... ... per cwt.	£13 10s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3d.	...
a	,, Crystals ... ... per ton	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3¾d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton	£95 to £100	...
b	,, Wire ... ... per lb.	1/1 to 1/9	...
b	,, Sheet ... ... ,,	1/1 to 2/9	...
p	Babbitts Metal and Anti-friction Metals—		
	Grade I ... ... per ton net	£154	£4 dec.
	Grade II... ... ... ,, ,,	£103	£3 dec.
	Grade III ... ... ,, ,,	£63	£1 dec.
c	Brass (rolled metal 2" to 12" basis) per lb.	10¾d.	...
c	,, Tubes (solid drawn) ... ,,	1/0½ to 1/1	...
c	,, Wire, basis ... ... ,,	10¾d.	...
c	Copper Tubes (solid drawn) ... ,,	1/3	...
g	,, Bars (best selected) ... per ton	£110	...
g	,, Sheet ... ... ,,	£110	...
g	,, Rod ... ... ,,	£110	...
d	,, (Electrolytic) Bars ... ,,	£84 7s. 6d.	...
d	,, ,, Sheets ... ,,	£1 8 10s.	...
d	,, ,, Wire Rods ,,	£94 7s. 6d.	...
d	,, ,, H.C. Wire per lb.	11¾d.	...
f	Ebonite Rod... ... ... ,,	2/8 to 2/6	...
f	,, Sheet ... ... ,,	2/8 to 2/6	...
n	German Silver Wire ... ... ,,	2/1	...
h	Gutta-percha, fine ... ... ,,	nom.	...
h	India-rubber, Para fine ... ... ,,	8¾d.	¾d. dec.
i	Iron, Pig (Cleveland No. 3.) ... per ton	86/-	14/- inc.
l	,, Wire, galv. No. 8. P.O. qual. ,,	£20	...
g	Lead, English pig ... ... ,,	£20	25/- dec.
g	Mercury ... ... per bot.	£22 17s. 6d.	2/6 dec.
e	Mica (in original cases) small ... per lb.	6d. to 8/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/- to 20/- & up	...
p	Phosphor Bronze, plain castings ,,	1/3½	...
p	,, ,, drawn bars & rods ,,	1/5	...
p	,, ,, rolled strip & sheet ,,	1/3½	...
p	,, ,, wire... ... ... ,,	1/6	...
o	Platinum ... ... per oz.	£10 12s. 6d.	27/6 dec.
d	Silicium Bronze Wire ... ... per lb.	1/2	...
r	Steel, Magnet, in bars ... ... ,,	7½d.	...
g	Tin, Block (English) ... ... per ton	£163 to £163 10s.	£4 15s. dec.
n	Wire, Nos. 1 to 16 ... ... per lb.	8/5	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Messrs. James Forster & Co., reporting on March 15th, stated that the lead market showed a steadier tone last week after the recent heavy "shake-out," and the Producers' Association has partially regained control of prices. Demand continues to be exceedingly quiet both in this country and on the Continent. Supplies are excessive, and there is no news yet of any restriction of production. Moreover, during the second half of the year the market will be called upon to absorb additional supplies of lead from the Mount Isa Mine, Australia, which is expected to produce 40,000 tons during that period. Unless there is a change in present conditions of supply and demand, a further fall in values seems to be inevitable. The Board of Trade returns for February show imports of 25,706 tons and exports of 3,472 tons, leaving 22,234 tons for home consumption.

Winding-up Petition.

Electramonic (Foreign) Rights, Ltd.—A petition has been presented to the High Court for the winding up of the above-named company by Mr. S. Sebba, 7 and 8, Great Winchester Street, E.C.2, creditor, and will be heard in London on March 24th.

Irish Free State Electrical Imports.

The imports of electrical goods, excluding machinery, into the Irish Free State attained a value of £50,095 during January last, as compared with £40,804 in the corresponding month of 1929.

New Indian Companies.

Among the new electrical concerns recently organised in India are the Dhulia Electric Supply Co., 50-56, Custom House Road, Fort, Bombay, capital 2,50,000 rupees; and the Tata Hydro-Electric Agencies, Ltd., Bombay House, 24, Bruce Road, Fort, Bombay, 77,00,000 rupees.

Swedish Foreign Electrical Trade.

According to the official returns electrical machinery to a value of £144,400 was imported into Sweden during January last as compared with £72,200 in the corresponding month of last year. There was also an increase in the exports of similar machinery from Sweden—from £202,000 to £218,300.

German Electrical Imports and Exports.

The official trade returns just to hand show that the imports of electrical machinery and apparatus into Germany during last year attained a value of £2,541,600, as compared with only £2,280,350 in 1928. On the other hand, the exports of similar material from Germany reached a total of £28,944,500 as compared with £24,434,450 in the preceding twelve months.

Swedish-American Co-operation.

The leading separator manufacturing company in Sweden, Aktiebolaget Separator, has concluded an agreement for co-operation with the American General Electric Company. The Swedish company has taken over the agency for Sweden for the "Santo" electrical refrigerating apparatus which is produced by the American company. This agency is considered a valuable acquisition, since the Separator Company will be able to deliver complete machines for modern dairy plants. At present the Swedish company employs refrigerating apparatus made at the plant of its affiliated company in Germany.

New Dutch Company.

The Splendor Glow Lamp Company has formed the N.V. Splendor-Radio, at Nijmegen, with a share capital of 250,000 fl. for the production and sale of radio apparatus.

Electricity Supply and Electrical Manufacturing in Japan.

At the end of 1929 there were 493 companies in the Japanese electricity supply industry, their aggregate capital being 2,387 million yen (£238,700,000). The companies engaged in the manufacture of electrical machinery and apparatus numbered 268, with a total capital of 260 million yen (£26,000,000).

Domestic Refrigerators for Malaya.

A memorandum on the demand for domestic refrigerators in Malaya has been prepared by the Department of Overseas Trade from information furnished by the British Trade Commissioner at Singapore, and issued to firms whose names are entered on its Special Register. Interested British firms can obtain a copy upon application to the Department, 35, Old Queen Street, S.W.1. (Reference AX. 9273.)

Wages in the Electrical Industry.

The Industrial Correspondent of the *Daily Herald* states that "the Electrical Trades Union has become tired of the abortive joint investigation on engineering wages and has decided to withdraw from this." The E.T.U. is one of the engineering trade unions which have been negotiating jointly for the past six years with the Engineering and Allied Employers' Federation for increased wages. The union executive has decided that no progress appears possible with the unwieldy group at present dealing with the question, and the next development is likely to be a demand for wages advances in the electrical manufacturing industry as "that section is known to be prosperous."

Lighting and Power Notes.

Alderley Edge and Wilmslow.—ALTERNATIVE ELECTRICITY TARIFFS.—The Alderley Edge and Wilmslow Electricity Board has adopted the following alternative scale of charges for electricity: A fixed charge of 20 per cent. per annum up to £60 ratable value, and ten per cent. on ratable value in excess of £60, plus 1½d. per kWh consumed, with no meter rent. The charge for water heating during restricted hours will be ½d. per kWh, while the charge for heating and power will be reduced to 1½d. per kWh for the summer quarters, the present charge of 3d. per kWh to remain for the winter quarters.

Australia.—BUNNERONG POWER STATION.—In their annual report the Sydney Commissioners outline the work done in connection with the construction of the Bunnerong power station. Steady progress has been made with the erection of the buildings and plant, and the first section was sufficiently advanced to enable a portion to be placed in operation on January 2nd, 1929. The first section of the station comprises six 25,000-kW turbo-alternators and 18 boilers. Of these four generating units together with the necessary auxiliary plant, switchgear, &c., and 12 of the boilers, were in operation by the end of September last. The cost of the station up to September 30th last amounted to £3,149,360, and a further expenditure of £431,587 is required to complete the first section. To meet the additional demand anticipated up to the end of 1935 it is expected that the station will have cost about £4,480,947.

Bath.—LOAN.—The Town Council has applied for sanction to a loan of £20,000 for mains and services for the next two years.

Birkenhead.—ELECTRICITY SUPPLY PROGRESS.—We have received from Mr. F. E. Spence, borough electrical engineer, some interesting particulars regarding the growth of the Corporation electricity undertaking during the past five years. At March 31st, 1925, the Corporation's area of supply covered 12 sq. miles; to-day the districts to which supplies are given cover approximately 69 sq. miles. The capacity of the plant installed was 10,000 kW, as compared with 25,000 kW at present, while the total length of mains in operation has increased from 142 to 272 miles. The number of consumers connected has risen from 8,604 to 20,223. During the year ended March 31st, 1925, the electrical energy sold for all purposes was 10,534,270 kWh, which compares with 24,593,680 kWh sold during the year ended December 31st last. Appliances out on hire (including sales) have increased from 1,591 to 11,952. Under the assisted wiring scheme, which was commenced in August of last year, 2,444 applications for supplies have been received, while 946 houses have been wired and connected.

Blackpool.—SUPPLY AREA EXTENSION.—The Engineering Advisory Committee of the Mid-Lancashire Electricity Advisory Board has approved a scheme submitted by the borough electrical engineer of Blackpool, in connection with an application to the Electricity Commissioners for an Extension Order to include Hardhorn-with-Newton, Singleton, Weeton-with-Preece and Westby-with-Plumpton in Blackpool's district of supply. The coastal area between the northern boundary of Blackpool and Preston has been apportioned between the boroughs of Preston and Blackpool and the borough of Lytham St. Annes.

Bolton.—MAINS EXTENSIONS.—The Corporation Electricity Committee is to lay mains in Victoria Road at a cost of £1,500.

Brighton.—ASSISTED WIRING SCHEME.—The Town Council has approved a scheme of assisted wiring by means of a prepayment-meter system of charging.

Caernarvon.—CHANGE-OVER.—The Town Council is to make application to the Electricity Commissioners to change over the system of supply from d.c. to a.c. at an estimated cost of £23,000.

Canada.—ELECTRICITY PRODUCTION.—According to the Dominion Bureau of Statistics at Ottawa, the total amount of electricity generated in Canada by central electric stations during 1929 was 17,629,306,000 kWh, including electricity generated from both water power and fuel. The corresponding total for 1928 was 15,931,447,000 kWh, while in 1927 the figure was 14,231,196,000 kWh. Electricity generated by water power showed an increase from 15,705,371,000 kWh in 1928 to 17,297,847,000 kWh in 1929.

RURAL ELECTRIFICATION.—With a view to enabling the Provincial Hydro-Electric Power Commission to make further considerable extensions to its rural service, the Ontario Government is asking the Legislature for an appropriation of $2,000,000. This amount will be placed at the disposal of the Commission which will be empowered to make loans to farmers of not more than $1,000 each, repayable in 20 years at a low rate of interest, to assist them in paying the cost of electrical installations. As a further encouragement to the use of electricity on farms the Commission has revised its schedule of rates and reduced the former maximum of $4.10 to $2.50 per h.p. per annum. Any deficit created in any district by the excess of operating costs over revenue will be met by the Government.

WATER-POWER DEVELOPMENT.—The Shawinigan Water and Power Company expects to begin work shortly on the development of the first six sites available for water-power development on the Upper St. Maurice River. The initial development is to be at Rapide Blanc, where 160,000 h.p. can be developed. The site in question is situated 25 miles north of La Tuque. In co-operation with the Quebec Streams Commission, the company is erecting a new storage dam at Toro Rapids on the Mattawin River, which will permit the installation of additional units at Grand'Mère and at La Gabelle of 25,000 h.p. and 30,000 h.p., respectively. A review of the company's activities states that it now has 803,650 h.p. of developed power, and also available for future development on the Upper St. Maurice and at various other points within the company's zone of operations undeveloped powers to the extent of 1,144,000 h.p. The electrical output last year amounted to 3,460,531,057 kWh.

Colchester.—LOANS.—The City Council has applied for sanction to an additional loan of £7,637 in connection with the erection of the new power station, &c., and also for £3,856, excess expenditure on the construction of e.h.p. transmission lines, for which £50,000 was borrowed.

Continental.—ITALY.—According to a return published by *l'Energia Electrica* based on figures obtained from generating stations estimated to represent 86 per cent. of the total production, the output of electrical power in Italy during last year amounted to 9,096,194,000 kWh, as compared with 8,442,216,000 kWh in 1928. Of the total, 8,793,813,000 kWh was produced by hydro-electric plants, as against 302,382,000 kWh from stations run by steam and internal combustion engines. During the year electric power to the extent of 243,740,000 kWh was "imported"—mainly from Switzerland—as against 229,068,000 kWh in 1928. The consumption of electric power in Italy per inhabitant is now estimated to amount to 271.5 kWh per annum, as compared with 252.1 kWh a year ago. The installed capacity of the hydro-electric plants in Italy increased during the past year from 2,696,000 to 2,963,000 kW, and that of steam and internal-combustion engine stations from 603,000 to 676,000 kW.

Conway.—NEW ELECTRICITY TARIFF.—The Town Council has prepared the following alternative tariff for the supply of electricity: A fixed annual charge of 20 per cent. of the ratable value of the consumers' premises, plus 1d. per kWh consumed for all purposes.

Dartford.—MAINS EXTENSIONS.—The Urban District Council Electricity Committee is to extend mains at a cost of £900.

East Africa.—ELECTRICITY SUPPLY SCHEME.—It is understood on good authority that the Government has practically completed negotiations with the Power Securities Corporation, Ltd., for the supply of electricity to the Dar-es-Salaam Central Railway and the Tanga district. If carried out this will be the largest electrical scheme in Eastern Africa—*Reuter* (Dar-es-Salaam).

East Grinstead.—BULK SUPPLY.—The Urban District Council is negotiating with the Weald Electricity Supply Co., Ltd., for a bulk supply of electricity.

East Ham.—NEW CABLES.—The Corporation Tramways and Electricity Committee has passed estimates, amounting to £2,495 for the alteration and extension of the lighting feeder cables in Shelley Avenue, and from Nelson Street to Stamford Road, and £3,504 for the laying of distributor cables in Bendish, Holme, Laurence, Malvern, Temple, Stamford and Oakfield Roads.

Exeter.—BULK SUPPLY.—The Corporation Electricity Committee has received sanction to the borrowing of £15,000 in connection with the provision of a bulk supply of electricity to the Exe Valley Electricity Company.

Faversham.—EXTENSION OF SUPPLY AREA.—The Town Council has decided to apply for a Special Order to extend the area of supply so as to include the villages of Hernhill, Boughton and Ospringe.

ASSISTED WIRING SCHEME.—The Council has adopted a scheme for the assisted wiring of houses with a maximum of eight points. The wiring will be done by a contractor to the terms of a rigid specification.

Hastings.—LOAN.—The Corporation Electricity Committee is applying for sanction to a further loan of £10,000 for house services.

Inverness.—PROPOSED EXTENSION OF SUPPLY AREA.—The Town Council is to apply for a Special Order authorising it to supply electricity within an area of 2½ miles of the Town Hall.

Japan.—NEW POWER STATION.—A new hydro-electric power station known as the Saku has recently been completed in Japan. It is situated about 80 miles from Tokio, and comprises three 28,000-kW turbo-alternators.

London.—FULHAM.—The Borough Council Electricity and Lighting Committee recommends the extension of mains at a cost of £1,520.

ST. MARYLEBONE.—The Borough Council Electric Supply Committee recommends the expenditure of £1,970 on the installation of 61 circuit breakers in place of existing fuse equip-

ment at the generating station, and of £4,600 on the provision and laying of ducts for the diversion of d.c. and e.h.p. feeders in connection with the erection of new switchgear.

North Wales.—Electricity Supply Conference.—A conference of the electrical engineers and representatives of local supply authorities is to be held to-day at Llandudno to discuss the present and future position of the electrical supply in the area of the North Wales and South Cheshire Joint Electricity Authority. It may be remembered that recently the North Wales Power Co., Ltd., introduced reduced charges for electricity subject to this concession being passed on to consumers. The main object of the conference is to discuss how the consumption of electrical energy can be best stimulated.

Portsmouth.—Loans.—With reference to the installation of switchgear in the proposed new switch house adjacent to the generating station, the engineer reported at a recent meeting of the Corporation Electricity Committee that the total cost would be: Switchgear, £41,760; switch house, £3,985; foundations, brickwork, &c., £2,500. It was decided to seek sanction to the borrowing of £48,245. The Committee has obtained sanction to loans of £10,090, in connection with the supply of electricity in bulk to the Midhurst and District Electricity Co., Ltd., and £29,000 in respect of the main transmission line to Emsworth.

Electricity Supply.—The Committee has agreed to provide a supply of electricity to Fort Southwick at an estimated cost of £1,500.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

Maidstone.—Lighting flat rate: From 5½d. to 4½d. per kWh. "Unit" charge under the two-part tariff: From 2d. to 1½d. Contract demand system: From 17s. to 16s. per 30-watt lamp per annum. No charge is to be made for meters when an electric cooker is installed.

Dover.—Higher lighting rate: From 5½d. (less ½d. cash discount) to 5d. (less ½d. cash discount) per kWh.

Burgess Hill.—*Burgess Hill and District Electric Supply Co., Ltd.*—Lighting: to 9d. per kWh. Heating and power: to 4d. per kWh. When the bulk supply is in operation it is expected that there will be a further reduction to 8d. per kWh for lighting and to 2d. per kWh for heating and power.

Fareham.—Heating and domestic purposes: from 1¾d. to 1½d. per kWh. Power: from 1½d. to 1¼d. per kWh; the charge for consumers of over 5,000 kWh has been reduced by ¼d. per kWh.

Cheadle and Gatley.—Heating, flat rate: from 1¼d. per kWh to 1¼d. per kWh for the two summer quarters, and 1d. for the two winter quarters. Power: from 2d. to 1¼d. per kWh. "All-in" rate: from 1d. per kWh to ¾d. per kWh in the summer quarters, and 1d. in the winter quarters. Full credit for meter rents will be allowed to all consumers who pay their accounts within 14 days.

Torquay.—New Boiler Plant.—The Town Council has decided to spend £34,540 on the installation of two water-tube boilers and auxiliaries at the Newton Abbot generating station, as a part of the £100,000 scheme which has been sanctioned for the installation of a 7,500-kW set.

Torrington.—Electricity Supply.—The Town Council has received an intimation from the Bideford and District Electric Supply Co. that the extension of the supply to the borough is to be proceeded with at once.

West Hartlepool.—Waste Steam Utilisation.—The South Durham Steel and Iron Co., Ltd., by means of devices for utilising waste steam, will in future produce nearly all its own electricity. The steam will operate two turbo-generators having a combined output of nearly 2,000 kW. This scheme will necessitate the cancellation of the company's contract with the local Corporation from which it purchased on an average about 5,500,000 kWh per annum. The loss for the present will fall on the Cleveland and Durham County Electric Power Company, from which company the Corporation received a bulk supply.

Weymouth.—Loan.—The Corporation Electricity Committee is applying for sanction to a loan of £10,000 for mains and services.

Mains Extensions.—The electrical engineer has been authorised by the Electricity Committee to lay a new main to supply houses proposed to be erected near the Westham playing fields, at an estimated cost of £240.

Wolverhampton.—Housing Supply.—The Town Council has decided to give a supply of electricity to 174 houses on the Parkfield Road estate.

Wrexham.—Loans Sanctioned.—The Town Council has received sanction to a loan of £14,000 for the following purposes:—Mains and services, expenditure in 1927-28, £423; prospective expenditure on mains and services, £10,177; prepayment meters, £1,600; consumers' wiring installations for hire purchase, £2,200.

United States.—New Plant.—According to *Power*, construction is planned this year by Kansas City of a complete new steam power plant adjacent to the present municipal plant. A 10,000-kW turbo-generator with condensing equipment will be installed, together with a steam generating unit of approximately 150,000 lb. capacity. This will be the first unit in a plant of 100,000-kW ultimate capacity. Other generating units to be added in the future will have a capacity of 30,000 kW each, and the boilers will be similar to the one installed this year.

Tramway and Railway Notes.

Bradford.—New Feeder.—The Corporation Electricity Committee recommends the provision of a traction feeder along the Thornton tramway route at an estimated cost of £2,141.

Track Reconstruction.—The Corporation Tramways Committee recommends that an additional loop be constructed from Horton Park Avenue to Great Horton Road, at an estimated cost of £1,471.

Canada.—Proposed Tube for Toronto.—The Toronto City Council has instructed the Toronto Transportation Commission to report on the possibility of a tube railway system to provide for rapid transit in certain parts of the City. On two previous occassions the matter has been under consideration, but action has not yet resulted.

Cheshire.—Traffic Signals.—The County Council has voted £1,000 for the provision of traffic light signals.

Continental.—Italy.—The technical committee of the Metropolitan Railways of Rome has issued general preliminary plans and specifications for a system of underground electric railways in that city. The scheme makes provision ultimately for six lines serving the whole of the Italian capital. Of these, three are destined for construction in the near future and for one of them definite plans have already been made. This last-named line will be 6¾ miles in length, and is estimated to cost about £3,000,000. The hub of all the lines will be the central railway station of Rome. The total distance involved in the six lines is 35 miles, of which about 15 miles is included in the lines planned for construction in the near future.

London.—Proposed Tramway Extensions.—Reporting on the question of extending the tramway to the St. Helier estate, the Highways and Housing Committees of the London County Council state that the estate is situated almost entirely in the Merton and Morden and Carshalton urban districts and that the northern boundary of the estate is about 2¼ miles by road from the London County boundary. Any extension of tramways to or through the estate would not, therefore, be a matter for the Council but for the South Metropolitan Electric Tramways & Lighting Co., Ltd., which has a tramway service terminating at Mitcham Cricket Green, about ¾ mile from the northern boundary of the estate. It is understood that this company would be willing to apply for Parliamentary powers to extend its tramways through the estate provided that the necessary road widening and the reconstruction of a bridge on the route were carried out. The Committees state that they have ascertained from the Minister of Transport that arrangements have been made between the Ministry and the Surrey County Council for widening parts of the road between the tramway terminus at Mitcham and the estate, and that negotiations are in progress with regard to dealing with the remaining portion of the road.

Paignton.—Railless Cars.—The sub-committee appointed by the Urban District Council to inspect railless-car systems has reported that it has viewed the systems in operation at Mexborough and Doncaster, and has come to the conclusion that railless cars have many advantages over trams.

Tavistock.—Extension of Time.—The Merrivale Light Railway Company has made application to the Ministry of Transport for an extension of time of one year for the completion of the railway.

Telegraph and Telephone Notes.

Chile.—Telephone Concession.—The Senate has approved the 50-year concession to the Chile Telephone Company granted by the Government for local and long-distance telephone services in Chile, with the right to connect with foreign services. The concession is automatically self-perpetuating in periods of 30 years each, should the Government not exercise its right of purchase at the expiration of the 50-year concession. —*Reuter's Trade Service* (Santiago).

Guernsey. — Telephony. — The revenue statement and statistics for the year ended December 31st, 1929, show that the States Telephone Department's gross revenue increased by £1,378 to £20,597, but the net profit declined by £36 to £682. The total number of lines in use, including junctions, increased by 129 to 4,458, and the mileage of underground circuits grew by 23 to 4,908 miles, while the mileage of overhead circuits fell by 43 to 2,385 miles. The total number of calls increased by 112,481 to 2,720,336, and trunk calls to and from Sark increased by 3,803 to 14,908. The number of telegrams and letters "telephoned" reached 26,789. The employés were reduced by two to 83 (engineer and manager: Mr. E. H. Bennett).

International Telephony.—LITHUANIA.—A telephone service available from all parts of Britain, including Northern Ireland, to Kaunas (Kovno) and Klaipeds was inaugurated on March 12th.

New Zealand.—MODERNISED RADIO STATIONS.—Wireless stations in the Pacific under the control of the New Zealand Government are being modernised. The Raratonga station is the latest for which a new transmitter has been ordered, in replacement of the old one. This station will link Wellington (New Zealand) and Apia (Samoa), forming an important link in the wireless network of the Pacific, the centre of which is Suva, Fiji. The equipment has been ordered from the same Australian firm which recently completed the installation of plant at Lord Howe Island.

Poland.—TELEPHONE PROGRESS.—Ten years ago, on the formation of the Polish State, the Administration of Posts and Telegraphs was faced with the task of building up uniform telephone and telegraph systems on the remnants of three different networks originally constructed by, and taken over from, the former partition powers. Prior to the 1914-18 war, the system in former Russian Poland was one of the most backward among European countries. The former Austrian inter-urban system was also in a bad state. Lack of funds forced the Government to hand over seven great urban telephone systems for exploitation to the Polska Akeyjna Spolka Telefoniczna (P.A.S.) of which company the Administration of Posts and Telegraphs controls 51 per cent. After several years of work 99,774 miles of interurban and 166,482 of ordinary lines were reconstructed. The increase in length of inter-urban lines, as compared with the length taken over from the partition powers, amounts to 150 per cent. The plan for long-distance telephone cables anticipates the construction of seven principal systems radiating from Warsaw, and one line from Katowice to Lodz, passing through Krakow. The cables will amount to over 2,000 miles in length, and there will be 46 amplification stations. The whole construction programme, to cost about £3,366,000, is scheduled to be carried out in from 8 to 10 years' time. The construction of the first and most important cable, that between Warsaw-Lodz-Katowice-Gieszyn with a junction to Krakow, was commenced in the beginning of 1929. Estimates of future receipts from the projected cable systems provide for the complete redemption of construction costs after 6 to 10 years of exploitation. All necessary telephone apparatus and constituent parts are being made by the State factory at Warsaw, which employs 1,500 workmen.

Tahiti.—TELEPHONE CONCESSION.—Tenders have just been invited for the establishment and working of a telephone system on the Island of Tahiti under a twenty years concession.

Telephony.—CANADA'S PREMIER POSITION.—Canada, with 241 telephone conversations annually per head of population, at last ousts America from her premier position among telephone users. The United States must for the present year be content with second place and a record, nearly ten times that of Great Britain, of 225 conversations per head per year. New Zealand with approximately 180 takes third place. Most European nations lag a long way behind. Denmark leads with approximately 137 conversations per head annually. Sweden comes second, followed at varying intervals by Norway, Austria, Holland, Switzerland, and Germany. After all those comes Great Britain with approximately 29 conversations per head per year, less even than Japan, whose population averages approximately 43 conversations annually.

The American Telephone and Telegraph Company (which controls the Bell system) spent during the past year some 633,000,000 dollars (about £126,600,000) on new plant and manufacturing facilities; it is expected that more than 700,000,000 dollars will be spent during the present year for similar purposes. British expenditure on telephones during the present year will be about ten and a half million pounds.

The Telephone Service.—YEAR'S GROWTH.—During the year ended December 31st, 1929, the total number of stations working was 1,848,468, an increase of 125,885, or 7.3 per cent. London claimed 661,977 of the total, an increase of 47,794, or 7.8 per cent.; England and Wales (excluding London) had 999,529, an increase of 67,726, or 7.3 per cent.; Scotland, 164,125, an increase of 8,932, or 5.8 per cent.; while the share of Northern Ireland was 22,837, or 6.7 per cent. Residence-rate installations numbered 416,296; the net addition during the year was 40,955, or 10.9 per cent., compared with a net growth in business-exchange installations of 24,282, or 3.8 per cent. The percentage of residence-rate subscribers to the total exchange subscribers was 38.8, as compared with 37.3 a year previously, and 25.1 in July, 1922, when the reduced tariff for residence lines was first introduced. In the London telephone area nearly half the subscribers' lines are now rented at the residence tariff, the percentage having increased from 30.5 in July, 1922, to 48.4 in December, 1929. The total number of call-office stations was 29,924, of which 5,803 were in the London area and 24,121 in provincial districts. The net addition during the year was 4,408, or more than double that in the previous year, *viz.*, 2,013. The number of kiosks in the London area increased from 1,214 to 1,581, and the number in the provinces from 4,807 to 5,960. Some 133 new rural exchanges were opened, bringing the total number up to 1,373, and 89 others were in course of construction. The total number of exchanges working was 4,606, of which 3,115 served rural areas.

Radio Notes.

Australia.—DEVELOPMENT.—A sum of £750,000 is to be spent on reorganising the broadcasting service. The scheme includes the erection of at least a dozen subsidiary stations in different parts of the Commonwealth and, when completed in about three years, is expected to provide a good service for about 95 per cent. of the population.

Canada.—LICENCES.—According to the Radio-telegraph branch of the Marine Department, in the ten months ended January this year the number of radio licences issued was 375,068, compared with 296,926 in January a year ago, as follows: Toronto, 54,355, an increase of 10,000; Montreal, 38,816, an increase of 9,000; Ottawa, 9,135; Winnipeg, 13,834; Calgary, 3,375; Edmonton, 2,615; and Vancouver, 14,846.

Holland.—"WIRED WIRELESS."—Telephone subscribers at The Hague can now listen to broadcasting stations by attaching a loud-speaker or headphones to their telephone instruments and pressing a button. Two programmes are Dutch (Hilversum and Huizen stations), while the third available is a mixed Dutch and foreign one. The change-over from one to another is effected by pressing a button. Already over 400 telephones have been fitted with the necessary attachments that make such reception possible. The installation is the first of its kind in Europe.

Public Loud-speakers.—LICENCES.—Gainsborough, Lincolnshire, innkeepers have learned that they are breaking the law by providing wireless entertainment for patrons without taking out entertainment licences. Seven of them recently applied to the local magistrates for such licences, which cost 5s. a year, but the applications were adjourned so that uniformity may be obtained throughout the county. The subject will be discussed by the Lindsey licensing authority, and meanwhile the Gainsborough magistrates have given sanction for the wireless entetainment to be continued.

Television Tests.—For the first time wireless artists will probably be seen as well as be heard at the end of the month, when simultaneous broadcasts of television and music are to be tested. The sound broadcast will be from the London regional transmitter on 356 metres, and the television transmission will be on the national wavelength of 261 metres. The broadcasts will emanate from the Baird Television Company's studios. The B.B.C. will be merely the transmitting agent. The dual broadcasts will be conducted from 11 to 11.30 a.m. every day, except Saturdays and Sundays, and from midnight to 12.30 a.m. on Tuesdays and Fridays.

The first "televisors," costing about £21 each, are now being issued by the Baird Television Development Company. No wireless receiving gear is included in the "televisor," which must, therefore, be connected to a suitable receiving set.

A Large Synchronous Condenser.

Several rotary condensers, outstanding in respect of their rating, were constructed during the past year by the A.E.G. Co. of Berlin, one of which, at 11 kV terminal volts, 60 cycles, and 600 r.p.m., is able to supply a lagging reactive power of 30,000 kVA, or a leading reactive power of 25,000 kVA. Features of the set are fully automatic service, embracing starting, braking, and operation, and consequently extremely simple service, safety, and reliability. The running cost of such large condensers is stated to be comparatively low, the losses being only slightly more than 2 per cent. of the rated capacity. In order to facilitate starting, provision is made for a starting motor which can run the machine-set up to normal speed in less than 90 seconds. The starting motor has an hourly rating of 3,000 h.p. and assists the set to cope with its second task, *viz.*, to bring an extensive section of the h.p. network up to voltage independently, and then maintain that voltage at its normal value for 60 minutes. The phase advancer then works under-excited and can supply up to 25,000 kVA capacitative reactive power to the section of the h.p. network temporarily isolated from the long-distance supply station. The energy then consumed by the starting motor is supplied by a steam-operated power station located in the centre of the consumption area. The actual phase advancing operation, embracing starting, connection to the network bus-bars, voltage regulation of the network, and re-synchronising after disturbances, is entirely automatic. The network charging service operates semi-automatically, *i.e.*, starting is automatic, whereas the charging capacity, or the line voltage, is adjusted manually. Electric braking in the event of danger invariably occurs automatically. The automatic features had to be relevantly designed in order that the actual phase-advancing service may be controlled automatically or manually, as necessity demands. Electrical interlocks are consequently provided to enhance the safety of manual control, the interlocks being so devised that faults in the sequence of the several switching manœuvres are impossible.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Antwerp.—March 24th. Municipal Council. Crane plug boxes for electric cranes and 20 junction boxes for the cables supplying electric motors. (B.X. 6243.)*

Argentina.—Buenos Aires.—May 22nd. Department of Sanitary Works. Three electric pumping sets, piping and valves. (A.X. 9219.)*

Australia.—Melbourne.—May 5th. State Electricity Commission of Victoria. Supply of 22,000-V current-limiting reactors. (B.X. 6236.)*

May 12th. Supply of 22,000-V pin-type supporting insulators, for 12 months. (B.X. 6179.)*

April 22nd. Posts and Telegraph Department. Braided switchboard cable. (B.X. 6201.)*

April 29th. Telephone relays. (B.X. 6157.)* P.A.B.X. relay sets. (B.X. 6158.)*

May 20th. Terminal strips. (B.X. 6247.)* Telegraph instruments. (B.X. 6248.)*

Sydney.—April 28th. Department of Public Works. Electrically-driven high lift and low lift pumping plants, &c. (A.X. 9219.)*

Aylesbury.—Electricity Department. Supply of electrical materials for 12 months, commencing April 1st, 1930. (See this issue.)

Bexhill.—April 22nd. Electricity Department. Laying and jointing of approximately 1,600 yd. 0.05 sq. in. three-phase 11,000-V cable. (March 14th.)

Birmingham.—March 29th. Tramways and Omnibus Committee. 1,400 tons of grooved steel girder tramway rails and necessary fish plates. Specification from A. C. Baker, General Manager, Tramways & Omnibus Offices, Council House.

Congleton.—Corporation. April 1st. H.p. and l.p. switchgear, transformers, kiosks, h.p. and l.p. cables, and l.p. overhead distribution. (March 7th.)

Dundee.—April 10th. Electricity Department. Supply of e.h.p. and l.p. paper insulated l.c. and double steel tape armoured cable. (See this issue.)

Eccles.—March 24th. Electricity Committee. Cables required during year commencing April 1st, 1930. Specification (deposit £1 1s.) from Borough Electrical Engineer, Electricity Works, Cawdor Street, Patricroft.

Edinburgh.—March 22nd. Corporation. Installation of electric lighting in 156 houses. Specifications from Electrical Engineer, Dewar Place (deposit £1 1s.).

Egypt.—Alexandria.—March 27th. Ports and Lighthouses Administration. Electric cables. (B.X. 6199.)*

India.—New Delhi.—March 24th. Indian Stores Dept. Cab-tire-sheathed cables for 12 months. (B.X. 6260.)*

Kirkcaldy.—March 28th. District Committee. Electric lighting installations for 44 houses. Schedules from Mr. G. B. Deas, architect, Central Chambers, Kirkcaldy.

Liverpool.—March 28th. Electric Supply Department. Supply of twelve 1,000-kVA step-down transformers. (March 14th.)

London.—Central Electricity Board.—March 24th. Supply, delivery and erection of 33-kV and lower voltage transformers for the North-West England and North Wales Electricity Scheme. (February 28th.)

March 31st. Supply, delivery and erection of metering equipment required in the area of the North-West England and North Wales Electricity Scheme. (February 28th.)

April 7th. Supply, delivery and erection of 66-kV and lower voltage transformers. (March 7th.)

London County Council.—March 24th. Supply and erection in Blackwall Tunnel of four electrically-driven exhaust propeller fans and two centrifugal blowing-fan sets. Four steel lattice girders, various steel joists, platforms, &c. (February 28th.)

April 14th. Supply and delivery of h.p. and l.p. cables and reconstruction of existing l.p. cables. (See this issue.)

St. Pancras.—April 3rd. Supply of e.h.p. switchgear. (See this issue.)

April 3rd. Borough Council. Supply of l.p. switchboards. (See this issue.)

Bethnal Green.—March 31st. Borough Council. Supply, delivery and erection of one 1,000-kVA and two 500-kVA three-phase transformers. (See this issue.)

New Zealand.—Wellington.—April 29th. Public Works Department. One 10,000-kVA synchronous condenser and accessories. (B.X. 6034.)* Single-phase transformers and accessories. (B.X. 6035.)*

May 6th. 750-kVA transformers for Arapuni power scheme. (B.X. 6095.)*

May 13th. 17·0-kV transformers for Mangahao power scheme. (B.X. 6096.)*

May 27th. Supply of 110-kV suspension insulators for the Waitaki Power Scheme. (B.X. 6216.)*

June 24th. Outdoor steelwork and 110-kV switchgear for the Waitaki power scheme. (B.X. 6238.)*

May 13th. Posts and Telegraph Department. Terminal strips. (B.X. 6209.)*

Normanton.—March 26th. West Riding Education Committee. Electric lighting installation at Grammar School. Education Officer, West Riding County Hall, Wakefield.

Swindon.—April 4th. Great Western Railway. Supply of electric wires and cables and telegraph ironwork. (See this issue.)

South Africa.—Johannesburg.—March 29th. Municipal Council. Metal-filament traction lamps. (B.X. 6246.)*

Stoke-on-Trent.—April 9th. Electrical Engineer's Department. Supply and erection of e.h.p. and l.p. overhead transmission lines. (See this issue.)

West Ham.—March 27th. Board of Guardians. Electrical work and the laying of main and sub-main cables and wiring of the various blocks at the Central Home, Union Road, Leytonstone. (March 7th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.

Contracts Closed.

Australia.—Melbourne.—State Electricity Commission of Victoria:—

Instruments and relays for Richmond terminal station (£2,491).—Australian General Electric Co., Ltd.; (£764).—Australian Westinghouse Electric Co., Ltd.

Instruments, meters, and relays for Yallourn power station extension (£1,811).—Australian General Electric Co., Ltd.

Ayr.—Town Council. Accepted:—

Electrical work for 80 houses (£339).—Darroch & Espie.

Colchester.—Town Council. Accepted:—

Measuring and recording instruments (£1,015).—Electroflo Meters Co., Ltd.

Consett.—Durham County Education Committee. Accepted: Electric light installation, Grove Estate School.—Embleton and Barker, Ltd.

Croydon.—Board of Guardians. Accepted:—

Electrical fittings and appliances for six months.—Commercial Electric Co.

Durham.—County Council. Accepted:—

200 gross reflex lenses (£360).—Franco-British Electric Co., Ltd.

East Ham.—Town Council. Accepted:—

Four double-deck car bodies with trucks and brakes (£7,668).—Brush Electrical Engineering Co., Ltd.

Halesowen.—Urban Council. Accepted:—

Wiring houses on the Long Lane Estate and Colman Hill, Cradley (£271).—Robinson Bros.

Hastings.—Electricity Committee. Recommended:—

Switchboard (£116).—Crompton Parkinson, Ltd.

Oil switch unit (£116).—British Thomson-Houston Co., Ltd.

House service meters.—Metropolitan-Vickers Electrical Co., Ltd.

Joint boxes, v.i.r. cables, &c.—W. T. Henley's Telegraph Works Co., Ltd.

Paper insulated cables.—W. T. Glover & Co., Ltd.

India. — Bombay. — Corporation Standing Committee. Accepted:—

Renewing wiring of electrical installation at Municipal Buildings (Rs. 1,195).—Balmer Lawrie & Co. (Johnson and Phillips' materials).

London.—London County Council Education Committee. Electric installation at new secondary school in Homestall Road, Peckham :—

H. J. CASH & Co., LTD. (Recommended)...	...£1,354
Smethurst & Co. (London), Ltd.	... 1,380
Electrical Installations, Ltd.	... 1,545
J. Briggs, Electrical Contractors, Ltd. ...	... 1,561
Ellis & Ward, Ltd.	... 1,759
T. W. Berkeley Electrical Engineering Co., Ltd.	1,786
Malcolm & Allan (London), Ltd.	... 1,793
Barlow Bros. & Co.	... 2,140
Heath Pritchard, Ltd.	... 2,534

Installation of electric lighting at new secondary school at Streatham Vale :—

ELECTRIC INSTALLATIONS, LTD. (Recommended)	£699
G. H. Denne & Son, Ltd.	... 739
A. Dean & Co., Ltd.	... 754
J. Briggs, Electric Contractors, Ltd. ...	... 796
T. Clarke & Co., Ltd.	... 827
A. Hawkins & Son	... 839
Pinching & Walton	... 844
Smethurst & Co. (London), Ltd.	... 856
Berkeley Electrical Eng. Co.	... 1,037

ADMIRALTY. Accepted :—
308,000 Osram electric lamps.—General Electric Co., Ltd.

METROPOLITAN WATER BOARD.—Recommended :—
Four steam turbines with centrifugal pumps and two electric generators, for Surbiton waterworks (£48,930).—Worthington-Simpson, Ltd. (for Fraser & Chalmers turbines).

Palestine.—Palestine Electric Corporation, Ltd.
5,000 l.p. insulators and pins.—Equipment & Engineering Co., Ltd.

Portsmouth.—Electricity Committee. Accepted :—
Renewal of two economisers (£2,398).—E. Green & Son, Ltd.

Stockport.—Town Council. Accepted :—
Electric crane for the electricity works (£2,445).—Craven Bros.

Torquay.—Corporation. Two water-tube boilers, &c.

STIRLING BOILER CO., LTD. (Accepted) ...	£34,540
John Thompson Water Tube Boilers, Ltd....	34,989
Yarrow & Co., Ltd.	36,315
Babcock & Wilcox, Ltd.	36,811
Spearing & Co., Ltd.	37,840
Simon-Carves, Ltd.	38,000
Vickers Boiler Co., Ltd.	38,645

Wimbledon.—Electricity Committee. Accepted :—
7,500 kW turbo-alternator and plant (£19,342, plus £484 10s. for spare parts).—C. A. Parsons & Co., Ltd.

Worthing.—Town Council. Accepted :—
E.h.p. ring main distribution cables and connections for three sub-stations and e.h.p. cables between Ferring and East Preston (£28,740).—Callender's Cable & Construction Co., Ltd.

Forthcoming Events.

British Electrical Development Association.—Friday, March 21st. Savoy Hotel, Strand, W.C. Luncheon and Annual Meeting.
Friday, March 21st. Royal Society of Arts, John Street, Adelphi, W.C., 7.30 p.m. Salesmanship Conference.

Junior Institution of Engineers.—Friday, March 21st. 39, Victoria Street, S.W. 7.30 p.m. "Surface Combustion." Mr. M. V. Hurst.

Batti-Wallah's Society.—Friday, March 21st. Hotel Cecil, Strand, W.C. 7 p.m.—1 a.m. Annual dinner and dance.

Royal Institution of Great Britain.—Saturdays, March 22nd and 29th. 21, Albemarle Street, W. 3 p.m. "Atomic Nuclei and their Structure." Sir Ernest Rutherford, Pres. R.S.
Friday, March 28th. 9 p.m. "The Transmutation of Matter." Sir Ernest Rutherford, F.R.S.

Ideal Home Exhibition.—March 24th-April 17th. Olympia, W.

Illuminating Engineering Society.—Tuesday, March 25th. Home Office Industrial Museum, 7 p.m. "Textile Lighting." Mr. S. Anderson.

Royal Society of Arts.—Tuesday, March 25th. John Street, Adelphi, W.C. 4.30 p.m. "The Work of the British Association in Relation to the Empire." Mr. O. J. R. Howarth.

Electrical Power Engineers' Association (Manchester Local Technical Group).—Wednesday, March 26th. "Tap Changing of Transformers under Load." Mr. G. L. Porter.

Institution of Electrical Engineers.—Thursday, March 27th. Institution, London, W.C. 6 p.m. "Developments in Machine Telegraph Systems and Method of Operation." Mr. H. H. Harrison.

(North-Eastern Centre).—Monday, March 24th. Armstrong College, Newcastle-on-Tyne. 7 p.m. "The Imperial Chemical Industries, Ltd.'s Steam and Electric Power Plant at Billingham." Mr. H. A. Humphrey, Mr. D. M. Buist, and Mr. J. W. Bansall.

(North-Midland Centre).—Tuesday, March 25th. Hotel Metropole, King Street, Leeds. 7 p.m. "The Imperial Chemical Industries, Ltd.'s Steam and Electric Power Plant at Billingham." Messrs. H. A. Humphrey, D. M. Buist, and J. W. Bansall.

(North-Western Centre).—Friday, March 28th. Engineers' Club, Manchester. 7.15 p.m. "Marine Diesel Installations with Particular Reference to Auxiliary Machinery." Mr. J. Calderwood.

(East-Midland Sub-Centre).—Tuesday, March 25th. The College, Loughborough. 6.45 p.m. Ordinary meeting.

(West Wales (Swansea) Sub-Centre).—Friday, March 28th. Swansea. Ordinary meeting.

(North-Western Students' Section).—Tuesday, March 25th. Engineers' Club, Manchester. 7.15 p.m. "The Steel Melting Coreless Induction Furnace." Messrs. P. G. H. Burbridge and Mr. J. Marchbanks.

Meter and Instrument Section.—Friday, March 21st. Institution, Savoy Place, W.C.2. 7 p.m. Informal discussion.

South-Midland Students' Section.—Joint meeting with the Institutions of Civil and Mechanical Engineers, Graduates' and Students' Sections. Friday, March 21st. Grand Hotel, Birmingham. 7 p.m. Discussion on "The Engineer of the Future." To be opened by Mr. A. B. Sadler, Mr. R. A. R. Cole, and Mr. D. M. Cathcart.

Physical Society.—Friday, March 28th. Imperial College of Science, South Kensington, S.W. 5 p.m. Annual general meeting.

Birmingham Electric Club.—Friday, March 28th. Grand Hotel, Birmingham. 7 p.m. "The Principles Underlying Television." Mr. J. B. Kramer.

Association of Mining Electrical Engineers (Lothians Branch).—Saturday, March 29th. Members' night.

(Western Sub-Branch, Swansea).—Saturday, March 29th. Informal discussion on H.M. Electrical Inspector's Report for 1928.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following devices :—

DICONDUM automatic ironing machine.
RHONOPHONE device for deaf people.
VIBROLUX vibrators.
Small carbon sacs used in h.t. batteries.

New Work on Silver Plating.

At a recent joint meeting of the Electroplaters' and Depositors' Technical Society with the Faraday Society a paper on "The Electrodeposition of Silver from Argentocyanide Solutions" was presented by Dr. S. Glasstone and Dr. E. B. Sanigar, in which views of considerable interest were put forward.

As there appeared to be no information available concerning the effect of sulphate iron on silver deposits, the work described was undertaken to investigate the matter further, and included experiments on the influence of other anions.

The work described led to the following conclusions :—

1. The addition of carbonate, or of excess free cyanide, to an argentocyanide plating solution decreased the hardness of the silver deposit.

2. Formate, acetate, hydroxide, phosphate, and sulphate caused a hardening of the deposit, whilst borate and chloride increased the hardness considerably.

3. The deposits from sodium and from potassium argentocyanide solutions appeared to be identical.

4. Polarisation during silver deposition was quite considerable in solutions containing carbonates, formates, nitrates, acetates, sulphates, chlorides, phosphates, borates, and hyroxides, but very small in the presence of a large excess of free cyanide; the polarisation in sodium solutions was slightly greater than in corresponding potassium solutions.

5. There was no obvious connection between cathodic polarisation and the nature and hardness of the deposit; the cathodic potential was influenced mainly by the alkali metal ions, and the nature and hardness of the deposit by the added anions.

6. The limiting current density at which silver could be deposited with 100 per cent. efficiency was a function of the silver concentration of the electrolyte, and not of its conductance.

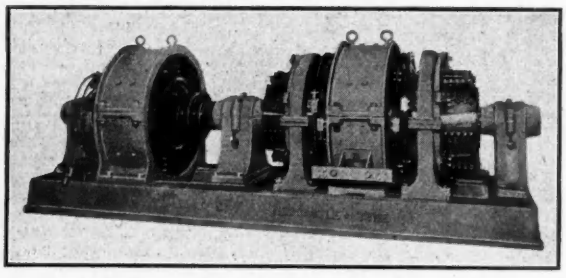
Notes.

Educational.

Short courses in engineering science and electrical engineering for teachers in technical schools, &c., will be held at Merton College, Oxford, from July 19th to July 30th. Teachers who desire to attend one of the courses should make application to the Board of Education on Form 106 U (T.i) before April 1st.

A Large Plater's Motor-generator.

The report of the Electro-Platers' Convention on page 386 of our issue of February 28th mentioned a motor-generator which was claimed to be the largest installed in this country for chromium-plating work, the equipment delivering 12,000 amperes at 6 volts. Messrs. J. H. Holmes & Co., Ltd., inform us that



Large Electro-plating Motor-generator Set.

they have just recently built a motor-generator set which they believe to be the largest that has ever been made in this country for plating work, as their machine is capable of giving an output of 80 kW against the 72 kW mentioned above. The accompanying reproduced photograph shows the equipment, the dynamo armature of which was exhibited at the recent British Industries Fair, at Birmingham.

Appointments Vacant.

Costing and stores clerk for Reigate Corporation Electricity Department. Junior engineering assistant for Reading Corporation Tramways and Motors Department. Full-time assistant master in electrical engineering and elementary mathematics at the Hackney Technical Institute for the L.C.C. Graduate assistant in mechanical engineering and graduate assistant in electrical engineering at Rutherford Technical College for Newcastle-upon-Tyne Education Committee. Meter mechanic and tester for Darwen Electricity Department. Junior mains assistant and showroom attendant for Walsall Electricity Department. Test room assistant for Newport (Mon.) Electricity Department. Technical assistant for Stoke Newington Electricity Department. Graduate assistant master in the electrical engineering and physics departments at the School of Engineering and Navigation, Poplar, for the L.C.C. (See our advertisement pages to-day.)

H.P. Steam Pipes.

In view of the growing employment of higher steam pressures in electricity generating stations, the Compagnie Parisienne de Distribution d'Electricité is having a series of tests made in the laboratory attached to the Ecole Centrale des Arts et Manufactures in Paris of the most suitable form of material for making steam pipes. At a recent meeting of the French Academy of Sciences, Messrs. Galibourg and Samsoen gave some particulars of experiments made with pipes made of carbon-steel, others of nickel-steel, and others of nickel-chrome steel.

The Electrical Association for Women.

On March 11th, at the annual meeting of the Birmingham and Midlands branch of the Electrical Association for Women, Mr. R. Borlase Matthews, M.I.E.E., gave a lecture on "Electricity in the Service of Women." He dealt principally with the ways in which electricity could be of the greatest possible service to country folk.

On March 12th a party of London members of the E.A.W. visited the Richmond House and Household Benefit Laundry at Hackney, which is equipped with the most modern and up-to-date electrical machinery.

Collieries and Electricity.

The annual dinner of the electrical staff of the Doncaster Collieries Association, Ltd., took place recently under the chairmanship of Mr. C. C. Bleach, chief electrical engineer to the Association. Representatives from all six collieries with which the Association is concerned were present, and there were on exhibition the latest miners' electric pit lamps and an electrical gas-testing lamp. The toast of the Association and its associated collieries was proposed by Mr. T. Quirk, chief electrician to the Carlton Main pits, to which the chairman, in responding, said he believed the Doncaster Collieries Association, Ltd., had been a pioneer in the supply of electricity on the lines now proposed on a larger scale by the Central Electricity Board. Unfortunately, collieries were not being given credit for the pioneering work they had done, and were being more or less ignored by the Electricity Board. Grouped collieries offered themselves to more consideration than they were getting in connection with such a scheme as the Government was proposing. The Doncaster Collieries Association not only furnished electricity for its own six mines, but also supplied the needs of shopkeepers and others near the pits, and the Association had wired over 5,000 houses. Mr. R. C. Wood, for 20 years electrical engineer at Brodsworth Colliery, toasted the electrical industry, and Mr. R. G. MacLaverty (Metropolitan-Vickers Electrical Co.), in responding, said the Doncaster Collieries Association last year generated and distributed 35¼ million kWh, an output which was equal to that of many municipal undertakings. Colliery owners should be encouraged wherever possible to generate electricity to their utmost capacity; he believed many collieries could produce at a lower cost than the super-power stations. Mr. I. Scott Mackenzie (Staveley Coal and Iron Co.) said his company and the Doncaster Collieries Association had done what the electricity grid scheme was now proposing to do. It remained to be seen what would happen with a national grid at 132,000 volts. He had just returned from Alsace-Lorraine, where the load was nothing like so heavy as that of the grid was expected to be, but they were having considerable difficulties. If the national grid did as well as the collieries' grid at Doncaster had done, the Board would be lucky.

Birmingham Electric Club.

The annual dinner of the Birmingham Electric Club was held on March 14th, when Mr. D. G. Brooks (president) occupied the chair. Mr. A. P. Young (manager of the Rugby works of the British Thomson-Houston Co., Ltd.), in proposing "The City of Birmingham," observed that notable in connection with electrical development was Priestley, who, in addition to discovering oxygen, first observed the action of electric sparks in the air. That led to the subsequent work of Cavendish, and, in more recent times, the fixation of atmospheric nitrogen by the blown arc process. By Birmingham's vision and ability, important sections of new industries had been absorbed, especially the small electrical accessory business. Those industries were pregnant with possibilities of future expansion. In responding, the Lord Mayor (Alderman M. L. Lancaster) said Birmingham's great electrical development was shown in the fact that a week's output in 1929 exceeded a year's output in 1906. That remarkable fact reflected the greatest credit upon those connected with the Birmingham Electric Supply Department.

The toast of the "Birmingham Electric Club" was submitted by Capt. P. P. Eckersley (formerly chief engineer of the B.B.C.), who said the technical man was the foundation of all business. The President, in responding, said the club had grown from a very small one into a position of great importance and value to electrical engineers.

Norway's Power Export.

It is understood that at the next World Power Conference, which is to be held in Berlin in June, a scheme will be put forward for the electrical transmission of power from Norway to Germany in a paper to be presented jointly by Mr. Stuevold-Hansen, formerly general director of the Norwegian Water-power and Electricity Department, Mr. Johan Kinck, engineer, and Mr. Alb. Norstrand. The scheme would involve the expenditure of at least £28,000,000, which amount would be sought to be raised in the United States, while the Siemens-Schuckert Company is credited with being engaged on the preparation of the plans for the execution of the work. From information which the Norwegian *Teknisk Ukeblad* has been able to obtain from the authors of the scheme, it appears that the project aims at the utilisation of three waterfalls, namely, the two Tokefallen and one fall in the South of Norway, and the transmission of 600,000 h.p. to Lubeck at 380,000 volts. The shortest route for the transmission line would be across the Skagerak by means of submarine cables from the vicinity of Arendal to Hirtshals, in Denmark, and then onwards into Germany by means of an aerial line; but, as it is considered impossible to manufacture submarine cables that could be guaranteed for that pressure, that method of solving the problem has been abandoned; moreover, such a scheme would prove to be disproportionately expensive. The promoters therefore contemplate the construction of an aerial line through Sweden and Denmark to Germany. It would be conveyed over the Drammensfjord at Svelvik by one span of 600 metres, and would cross the Oslo fjord to the north of Filtvedt by a span of about 2,000 metres. Slightly to the north of Helsingborg the line would traverse the Sound, which there has a width of 5,700 metres, by means of five spans. In the navigable channel, which has a width of 1,500 metres, the free height below the line would be 75 metres, which might possibly be reduced to 45 metres. The Fehmarn belt is 18 kilometres wide, and the greatest depth is 29 metres. In this case it would be necessary to build in the sea about 20 foundations for masts. At the deepest part of the Sound the free height below the line would be 75 metres. The masts in the navigable channel would have a height of 192 metres, while the other masts would be between 60 metres and 102 metres high, and they would be set up on reinforced-concrete caissons filled with sand, the caissons resting on stone foundations. The combined length of the transmission line from the power stations to the receiving station in Lubeck would be about

620 miles. The conductors would be hollow copper, except over the sea, where silicon bronze cables of 1,000 sq. mm. cross section are proposed to be used. It is calculated that the power would be utilised for 6,500 hours per annum; on that basis it would be possible to supply the power to Germany at a price of 97 marks per kW per annum, or 1½ pfennigs per kW-hour. A yield of 5 per cent. is counted upon, and a depreciation rate according to the annuity principle in the course of 30 years. As the undertaking would be maintained in first-class condition, it is thought that after the 30 years it would be possible to reduce the working expenses by one half and to give the supply to Germany at a much lower price. The idea is to form a Norwegian company with Norwegian and foreign capital to carry out the undertaking. The decisive factor will be the attitudes of the Governments of Norway, Sweden, and Denmark. The promoters of the scheme have already asked for the support of the Norwegian Government and they also approached the Swedish Government when it was at first proposed to seek to transmit energy *via* Sweden to Sassnitz, which idea has since been renounced. The German authorities are said to be much interested in the scheme.

Fatality.

The jury at a recent inquest held at Poulton, in returning a verdict of "Accidental Death" in the case of a boy of 14 years who was killed on his first job, added a recommendation that properly protected lampholders should be provided. The boy was employed by a firm of heating engineers and was working at the Joseph Cross Memorial Convalescent Home. When the electric light failed he and a tradesman went out in search of the electrician, and he was subsequently found lying on his back in about two inches of water. He was holding an electric lamp in his right hand, and his left hand was clutching the cable. One witness, in reply to Mr. A. J. McColgan, H.M. Inspector of Factories, said the globe was in the lampholder to which was attached two wires. One was in the holder, and a bare end about three-eighths of an inch long was sticking out, and that was in deceased's right hand. William Sumner, of Rochdale, electrician on the job, said the bare end of the wire seemed to him to have been pulled out of the holder. The lad would receive a shock of 200 V. The Coroner said that the more temporary an electrical installation the more necessity there was to ensure the holders being made more foolproof than in ordinary circumstances.

The Channel Tunnel.

Last week the report of the Committee appointed by the Government to consider the proposals to construct a Channel Tunnel was published. The report is favourable to the scheme. It is considered that such a tunnel could be built, operated and maintained satisfactorily; that it would increase intercourse with the Continent to the advantage of British trade; and that the work should be carried out by private enterprise without special financial assistance from the Government. Of the two schemes examined, the Channel Tunnel Company's scheme is favoured. The total cost of the realisation of this company's proposals would be £30,000,000, divided equally between it and its French counterpart. The work would take from 6½ to 7 years. Lord Ebbisham, in a minority report, dissented from the findings of the majority on the grounds that the scheme was uneconomic, as existing services were adequate and efficient, and that tariffs might be directed specially against the tunnel traffic.

Institution Notes.

Institution of Electrical Engineers.

SUMMER MEETING.—At the invitation of the Irish Centre (chairman, Mr. T. J. Monagham) the Institution is to hold its summer meeting in the Free State and Northern Ireland this year. On Monday evening, June 2nd, the visitors will assemble at the Gresham Hotel, Dublin. On the Tuesday there will be a motor trip in Co. Wicklow, inspection of overhead transmission lines, &c., and a dance in the evening at Dublin. The Wednesday will be occupied by a special train journey to Limerick to visit the Free State hydro-electric undertaking on the River Shannon. On the Thursday morning the brewery of Messrs. A. Guinness, Sons & Co. will be visited; during the afternoon the party will leave by special train for Belfast, where there will be a reception by the Lord Mayor and dancing in the evening. On the Friday morning Belfast harbour will be toured by steamer; later one party will land and visit the harbour power station and Messrs. Harland & Wolff's shipyard, while the other party will remain on the steamer for a trip down Belfast Lough. During the afternoon the power house, spinning and weaving departments, &c., of the York Street Mills will be inspected; there will be an alternative motor-coach excursion through Antrim and Ballymena to Glenariffe and back by the coast road. In the evening there will be a reunion dinner and dance at the Grand Central Hotel, Belfast.

CONVERSAZIONE.—The Institution's annual conversazione will take place on June 12th, as usual at the National History Museum, South Kensington, London.

NORTH MIDLANDS CENTRE.—ANNUAL DINNER.—The annual dinner and re-union of members of the North Midlands Centre of the Institution took place on March 11th at the Hotel Metropole, Leeds. Mr. Thos. Roles (Bradford) presided over a gathering of some 140 members and visitors, including Col. Sir Thos. F. Purves, president, and Mr. P. F. Rowell, secretary. There were only two toasts, in addition to that of "The King."

Proposing "The President," Mr. T. ROLES, chairman of the North Midlands Centre, said it was out of the old association of telegraphists that the Institution had originated and now they had a fitting sequel in the head of the Post Office Engineering Department as the President of the Institution.

COL. SIR T. F. PURVES, responding, referred to the decision of the Council to hold the summer meeting in Ireland, remarking that it was a shock to the Council to find that it had overlooked a prior invitation of the North Midlands Centre. That strongly-established centre, he felt sure, would be generous enough to agree that there were many reasons why the visit to Ireland would be exceptionally desirable, particularly for the possibility it offered of strengthening an area which was still rather weak in Institution membership, and also of perhaps doing something towards the vitally-important objective of further cementing happy relationships between Ireland and Great Britain in a general sense. The Shannon hydro-electric power scheme was certainly something well worth visiting by English electrical engineers, and he believed Irish people as a whole would regard it as a gesture of friendship that English engineers should visit that undertaking, despite the German origin of the plant. Meanwhile, members in the North Midlands District would regard the visit to their area merely as a pleasure postponed.

Mr. W. B. WOODHOUSE, proposing "The Guests," offered apologies for absence from Lord Barnby and Mr. Frank Hodges, members of the Central Electricity Board, and voiced the hope that the slight operation Mr. Hodges was to undergo would be completely successful and followed by a speedy recovery. They were glad to welcome, however, for the first time at their dinner, a representative of the Central Electricity Board in Mr. S. E. Fedden, representatives of other Centres and Sub-Centres, Major F. L. Watson, chairman of the Leeds section of the Institution of Mechanical Engineers, representatives of the Institution of Constructional Engineers, and others, not forgetting representatives of that most vital national industry, the coal trade.

Mr. A. W. ARCHER, chairman of the Export Committee, Central Collieries' Commercial Association, responding to the toast, wondered why there had been such remarkable silence in the speeches on the subject of the Coal Mines Bill. Was it an ominous sign of the attitude of the electricity industry? Were they hiding under the umbrella of the Federation of British Industries and saying nothing as an Institution of Electrical Engineers? He believed the Coal Mines Bill would be extremely helpful. Appealing specially to the electrical industry to support the Bill, Mr. Archer reminded the gathering that, whilst the gas and electrical industries (employing only a fraction of the people engaged in the coal industry) had made aggregate profits of £11,000,000 and £18,000,000, respectively, the coal industry, on which so much of the nation's welfare depended (employing about a million people), had that year lost £9,000,000. To his mind such a position was indefensible. He supported the Bill because he believed it would make economic justice possible for the coal industry. There could be no permanent substantial social peace in this country until the employés of that great industry were dealt with on equitable terms.

In responding to an extra toast proposed by Mr. F. S. G. HININGS, Mr. T. ROLES said it was no pleasure to the electrical industry to see the coal industry in its present condition. Cheap coal, as such, was by no means sought by the electrical industry. Cheap coal during the war had indeed been responsible for the discarding of a great deal of machinery which could not work on it. He did not believe either the electrical or gas industry would make trouble for the coal owners by reason of any necessary advance in the price of coal, unless there was an attempt to differentiate between consumers and charge the electrical and gas industries more in proportion to other industries. That would be a retrograde step, bad for the health of the nation and industry in general, and they could depend upon it that it would be resisted by the gas and electrical industries side by side.

STUDENTS' SECTION DINNER.—The twenty-third annual dinner of the London Students' Section was held on March 6th at the Florence Restaurant, Mr. J. W. Moffatt being in the chair. Mr. P. V. Hunter (vice-president) was guest of the evening. Mr. Crutch (hon. sec.), in proposing the toast of "The Institution of Electrical Engineers," thought that the alteration of the regulations governing the associate membership would result in fewer students dropping out of the Institution when they reached the age limit for students. The Council's representative on the Committee, Mr. H. T. Young, in proposing the toast of "the Students' Section," congratulated the members on their enthusiasm and attendance at meetings. The Council had under consideration a students' magazine which would contain reports of visits, students' papers, and articles on the latest engineering practice, as it felt that the *Journal* was too technical for the majority of students.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

At a recent meeting of the Exeter Council, the chairman of the Electricity Committee referred to the retirement of the electrical engineer, Mr. H. D. Munro, under the superannuation scheme. He said that Mr. Munro had been in the Corporation's service for 34 years, during which period the sales of electricity had risen from 1,431 to 66,000,000 kWh; he was a pioneer of the electricity supply industry. The chairman moved a resolution expressing the Council's thanks to Mr. Munro, with its best wishes for his future. The motion was carried with acclamation.

Mr. W. R. Caithness, of the British General Electric Co., Ltd., has been elected chairman of the N.S.W. State Council of the Australian Association of British Manufacturers. Mr. C. E. Mayo is deputy chairman.

Sir Philip and Lady Dawson were involved in an accident on Thursday last week when a car in which they were travelling skidded and overturned. Sir Philip received slight injuries, but the latest report is that he is not suffering from any ill-effects.

The Swindon Town Council has increased the salary of the borough electrical engineer, Mr. A. Nicklin, from £600 to £700 per annum.

The Colchester City Council has decided to increase the salary of its electrical engineer by £50 per annum as from March 1st, with a further increment of £50 a year hence.

The Reading Corporation Tramways Committee has placed on record its appreciation of the services of Mr. C. H. Stafford, chief assistant engineer of the undertaking, who is leaving, and its best wishes for his future success.

It is announced that Sir Harry Haward is to retire from the Electricity Commission at the end of this month upon the completion of his extended term of office. He will, however, continue to act in a consultative capacity. Sir Harry Haward was one of the original Commissioners appointed in 1920.

Obituary.—Mr. C. J. Phillips.—It is with great regret that we have to announce the death on the 11th inst. at the age of 79 years of Mr. C. J. Phillips, one of our telephone pioneers. He commenced his electrical career on the staff of Hooper's Telegraph Company and served as electrician on several submarine cable laying expeditions. He joined the Telephone Company (Bell) in 1879, and was appointed electrician to the United Company after the amalgamation. He held the position of provincial superintendent in the National Company at the time of transfer, and, being near the retiring age, he did not go over to the Post Office. Except for a visit to Brazil in 1913 on behalf of a London syndicate to report on a telephone property there, he did not engage in professional work. He was a great gardener and found congenial occupation in tending the flowers and fruits at his Orpington home. He was a man of sound judgment and great personal charm. The funeral took place on the 14th inst. at Mitcham Parish Church, and, in addition to the members of the family, it was attended by many of his old colleagues and friends, amongst whom we observed Col. Clay, Messrs. Cook, France, Gall, Goddard, J. E. Kingsbury, H. Kingsbury, and Preston.

Dr. J. W. L. Spence.—*The Times* reports the death, on March 15th, at Edinburgh, of Dr. John Webster Lowther Spence. Dr. Spence was associated with Dr. Röntgen in his early investigation of X-rays, and was one of the founders of the Radiological Department of Edinburgh Infirmary. In 1916 Dr. Spence lost his right arm, and only recently he underwent an operation on his left hand. The Carnegie Hero Fund Trustees awarded him an annuity for his service to humanity.

Will.—The late Admiral of the Fleet Sir Henry Jackson, chairman of the Radio Research Board, and a former First Sea Lord, left unsettled property valued at £10,924 gross (£4,520 net personalty).

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares.

New Companies Registered.

Bullarch Ignition Co., Ltd.—Private company. Registered in Dublin, March 12th. Capital, £2,000 in £1 shares. Objects: To carry on the business of automobile electrical engineers, &c. The directors are: E. S. Archdall, Maperath House, Kells, motor salesman; R. A. Bullock, 6, Beaufort Villas, Rathfarnham, Dublin, electrical engineer.

Pegasus, Ltd.—Private company. Registered March 12th. Capital, £2,000 in 1,000 7½ per cent. cumulative preference shares of £1 each and 20,000 ordinary shares of 1s. each. Objects: To acquire the business of a wholesale wireless and electrical engineer now carried on by A. G. Franklyn at 10, Victoria Street, Chapel Allerton, Leeds, as "A. G. Franklyn" together with the registered trade mark "Pegasus," and to carry on the business of manufacturers of and dealers in gramophones, radio-gramophones, &c. The directors are: A. G. Franklyn, Pine Ridge, Tinshill Road, Adel, near Leeds; J. E. Stott, 15, Clare Hill, Huddersfield. Registered office: 10, Victoria Street, Chapel Allerton, Leeds.

Spencer Radio, Ltd.—Private company. Registered March 8th. Capital, £2,000 in £1 shares. Objects: To adopt an agreement with K. S. S. Spencer, and to acquire from him complete working models of mechanical and scientific inventions appertaining to radio receiving sets, to manufacture and deal in gramophones and sound-reproducing machines, &c. The first directors are: W. C. Pritchard, Bishopswood, The Bishops Avenue, Finchley, N., printer; K. S. S. Spencer, 1, Levett Gardens, Seven Kings, radio engineer; S. B. Wright, 33, Sunnyside Road, Ilford, accountant. Secretary: S. B. Wright. Registered office: 136 to 142, Clerkenwell Road, E.C.

P. J. Frampton, Ltd.—Private company. Registered March 12th. Capital, £1,000 in £1 shares. Objects: To carry on the business of electricians, mechanical engineers and manufacturers and workers of and dealers in electricity, founders, &c. The first directors are: J. Gregson, 18, Watson Road, Blackpool, and P. J. Frampton, Chipley, Preston New Road, Blackpool, electrical engineers. Registered office: 25, Birley Street, Blackpool.

Official Returns of Electrical Companies.

B.E.N. Patents, Ltd.—Deposit on February 11th, 1930, of deeds of lands, buildings and hereditaments in Acton Lane, Willesden, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

C. F. Young, Ltd.—S. F. Aspell, 3, Welford Road, Leicester, was appointed receiver and manager on February 24th, 1930, under powers contained in debentures dated October 26th, 1923.

Brownie Wireless Company of Great Britain, Ltd.—Capital, £10,000 in £1 shares. Return dated December 31st, 1929 (filed February 15th, 1930). 9,720 shares taken up. £9,720 paid. Mortgages and charges, £7,000.

Sterling Telephone & Electric Co., Ltd.—Capital, £65,000 in 49,650 preference and 15,350 ordinary shares of £1 each. Return dated December 9th, 1929. 39,500 preference and 15,350 ordinary shares taken up. £24,500 paid. £30,350 considered as paid. Mortgages and charges, nil.

Greater London Power Co., Ltd.—Capital, £100 in £1 shares. Return dated November 27th, 1929. All shares taken up. £100 paid. Mortgages and charges, nil.

Selfix Electric Co., Ltd.—Capital £1,000 in £1 shares. Return dated December 27th, 1929. 691 shares taken up. £335 paid. £356 considered as paid. Mortgages and charges, nil.

Ruskington Electric Supply Co., Ltd.—Capital, £2,000 in 1,500 preference and 500 ordinary shares of £1 each. Return dated September 2nd (filed November 25th), 1929. 545 preference and 500 ordinary shares taken up. £1,040 paid, leaving £5 calls unpaid. Mortgages and charges, nil.

Selectors, Ltd.—Capital, £1,000 in £1 shares. Return dated November 5th, 1929. All shares taken up. £1,000 paid. Mortgages and charges, nil.

Dean & Noble, Ltd.—Capital, £1,000 in £1 shares. Return dated December 20th, 1929. All shares taken up. £1,000 considered as paid. Mortgages and charges, nil.

London Radio Manufacturing Co., Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1929. All shares taken up. £700 paid. £300 considered as paid. Mortgages and charges, nil.

Wolf & Morgan, Ltd.—Capital, £1,000 in £1 shares. Return dated December 5th, 1929. All shares taken up. £1,000 paid. Mortgages and charges, £6,500.

Davis Electrical Co., Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1929. 677 shares taken up. £377 paid. £300 considered as paid. Mortgages and charges, nil.

Neon Lights (1928), Ltd.—Capital, £2,000 in 1s. shares. Return dated October 30th (filed December 11th, 1929). All shares taken up. £300 paid. £1,700 considered as paid. Mortgages and charges, nil.

Shirebrook Electric Supply Co., Ltd.—Capital, £5,000 in £1 shares. Return dated January 13th, 1930. 4,800 shares taken up. £3,700 paid (being £1 per share on 2,800 and 10s. per share on 2,000 shares), leaving £100 calls unpaid. Mortgages and charges, nil.

Brookhirst Switchgear, Ltd.—Capital, £550,000 in £1 shares. Return dated January 6th, 1930. 126,002 shares taken up. £30,502 paid. £95,500 considered as paid. Mortgages and charges, £25,000.

Radio Supply Co., Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1929 (filed February 14th, 1930). 599 shares taken up. £599 considered as paid. Mortgages and charges, nil.

Orion Lamps, Ltd.—Capital, £2,000 in £1 shares. Return dated December 7th, 1929. 1,245 shares taken up. £1,245 paid. Mortgages and charges, nil.

W. A. Rood, Ltd.—Capital, £800 in 700 preference and 100 ordinary shares of £1 each. Return dated January 8th, 1930. 415 preference and 100 ordinary shares taken up. £415 paid on the preference shares. £100 considered as paid on the ordinary shares. Mortgages and charges, nil.

Foundation Co., Ltd.—Charge on the Offington Park Estate, Durrington, near Worthing, dated March 1st, 1930, to secure all moneys due or to become due from the company to Lloyd's Bank, Ltd., not exceeding £60,000 (supplemental to memoranda of deposit dated November 25th, 1926, and May 3rd, 1928).

Aconic Radio, Ltd.—Debenture dated February 26th, 1930, to secure £6,000, constituting a fixed charge on all lands, buildings, fixtures, plant and fixed machinery (subject to charge dated February 6th, 1930, in favour of Lloyd's Bank, Ltd.), and a first floating charge on the company's undertaking and other property, present and future, including uncalled capital. Holder: J. L. Gottlieb, 10, Hillcrest Avenue, N.W.11.

Artandia, Ltd.—J. M. Napier, 317, High Holborn, W.C.1, was appointed receiver on February 28th, 1930, under powers contained in instrument dated January 17th, 1928.

Staffordshire Electrical Accessories Co., Ltd.—D. H. Bates, 10, Cheapside, Hanley, Stoke-on-Trent, was appointed receiver and manager on March 3rd, 1930, under powers contained in debentures dated July 29th, 1921.

Surrey Wholesale Electrical Co., Ltd.—Capital, £1,000 in 500 "A" shares of £1 each and 10,000 "B" shares of 1s. each. Return dated January 1st, 1930. 451 "A" and 8,600 "B" shares taken up. £275 paid. £6 calls unpaid. £600 considered as paid. Mortgages and charges, nil.

Sussex Electricity Supply Co., Ltd.—Capital, £20,000 in £1 shares. Return dated December 25th, 1929. 18,049 shares taken up. £18,049 paid. Mortgages and charges, £10,000.

British Electrical Reproduction Co., Ltd.—R. L. Latimer, 4b, Fredericks Place, Old Jewry, E.C.2, ceased to act as receiver and manager on February 15th, 1930.

Langham Radio, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated February 27th, 1930, to secure all moneys due or to become due from the company to the Westminster Bank, Ltd.

Vee Cee Dry Cell Co., Ltd. (old company).—H. M. West, C.A., 1, Station Road, Reading, ceased to act as receiver and/or manager on March 7th, 1930.

City Notes.

Haslam & Newton, Ltd.

Presiding at the first annual meeting on March 10th, Mr. C. A. Newton (chairman) in moving the adoption of the report and accounts, said that the electrical side of the business, together with the subsidiary building business, had made profits beyond the figures mentioned in the prospectus, but owing to the depression in the shipbuilding and artificial silk trades, the "Haslam end" of the business had been unable to make a profit, although the loss was very small (approximately £300). It had been their custom to spend fair sums on experiment and development and during the past year they had done rather more than usual, which had affected the present profit adversely. The Derby Cables factory had been erected by the subsidiary company, J. K. Ford & Weston, Ltd., and the factory was fully employed day and night. All branches of the business were in a healthy state, and they had some promising developments. During the year some notable contracts had been carried out, which included the complete electrification of the R.101, including the wireless generating equipment, and a contract in Berlin for the German Post Office long-distance wireless service. On the refrigerating side they had under construction what was probably the largest experimental refrigerating station in the world for the British Government. The report and accounts were adopted.

Waygood-Otis, Ltd.

Presiding at the annual meeting on March 13th, Mr. Henry C. Walker (chairman) said that in spite of keen competition, the profits earned continued to be satisfactory, and the volume of sales had continued to improve during the past year. Large contracts were in hand for the leading banks, insurance and railway companies, both in London and the provinces, as well as for the large London and provincial stores and industrial undertakings. The company had been entrusted with an order from the Canadian Pacific Steamship Co. for the lifts for the liner *Empress of Britain* at present in course of construction on the Clyde. This equipment would be a striking advance on any previous ship installation. The association with the Otis Elevator Co. had been valuable in the extension and development of business. Referring to the company's investments, he said that a substantial part of these consisted of interests in associated companies engaged in the lift industry in other parts of the world and they had proved highly remunerative. The report and accounts were adopted.

Kensington & Knightsbridge Electric Lighting Co., Ltd.

The accounts of this company were abstracted in our last issue, p. 508; the annual meeting was held on March 13th. Col. R. E. Crompton (chairman), who presided, said that during the year £29,297 was spent on capital account. The rapid growth of the company's business compelled them to accelerate the work of changing the system from d.c. to the new standard a.c. system, and they proposed therefore to embark upon an intensive programme in the current year. The electrical energy sold during the year under review amounted to approximately 19,500,000 kWh, an increase of 21 per cent., as compared with 1928, and the average overall return was 2.237d. per kWh, as against 2.514d. Compared with the corresponding return five years ago, consumers had benefited during the period to the extent of nearly 40 per cent. Referring to domestic development, Col. Crompton said that whereas in 1924 lighting represented 69 per cent. of the sales of electricity, in 1929, supplies for lighting represented only 33 per cent. of the total sales. The connections at the end of the year showed an advance of 3,089 kW. The report and accounts were adopted.

British Insulated Cables, Ltd.

The profit for the year ended December 31st, 1930, was £685,980, as compared with £617,951 in the preceding year. A balance of £250,090 brought forward is added, making £936,070. Provision is made for debenture interest, preference dividends, &c., £100,000 (the same) is appropriated to depreciation on buildings, plant, machinery, &c., and £198,333 (against £299,966) is transferred to reserve account. A final ordinary dividend of 10 per cent. is to be paid, again making 15 per cent. for the year, and £280,807 is carried forward. During the year the ordinary shareholders received as a bonus one new ordinary share for each four held, together with three new 5½ per cent. preference shares for each eight ordinary shares held (making a total of 333,333 new ordinary shares and 500,000 preference shares, all of £1 denomination). The report states that there was an increase in turnover during the year, and the result is regarded as satisfactory. A sum of £300,000 which had been held in suspense for taxation claims and other matters is now no longer required for these purposes, and has been set aside to form a dividend equalisation account. Meeting: To-day (Friday) at Liverpool.

Clyde Valley Electrical Power Co.

The report for the year ended December 31st last shows a profit of £354,495, as compared with £304,296 in 1928. To this is added £84,586 brought forward, making £439,081 available. It is proposed to pay a final dividend of 5 per cent. on the ordinary shares issued prior to 1929, making 8 per cent. for the year, and to pay a dividend of 8.9293d. per share on the new ordinary shares issued on April 24th, 1929, being at the rate of 8 per cent. from due dates of calls to December 31st. The staff benevolent fund receives £10,000, and £808 is appropriated for writing off the cost of the 1929 ordinary share issue, leaving £88,288 to be carried forward. The number of consumers at the end of the year was 48,700, an increase of 21.75 per cent. The alteration of the supply frequency from 25 cycles to 50 cycles is proceeding, and it is expected that the work will be completed in approximately 2½ years. A 20,000-kW turbo-alternator has been installed at Yoker power station, and since September last has delivered

energy to the "grid" lines of the Central Scotland Electricity Scheme, and to consumers whose supply frequency has already been standardised. Meeting: April 2nd.

Harrow Electric Light & Power Co., Ltd.

The annual meeting of this company was held recently, Mr. G. W. Spencer Hawes (chairman and managing director) presiding. In presenting the report and accounts, the chairman said that the number of consumers connected at the end of the past year was 5,153, an increase of 341, and the output was 2,740,443 kWh. Despite the further reduction of prices which was made last year, the increased sales of electricity had raised the revenue to a total of approximately £40,000. Over £8,000 had been expended on the extension of the distributing system, and during the current year the capital expenditure would in all probability be somewhat larger, as they had under consideration the establishment of a distributing station in South Harrow to deal with the increased supplies of electricity which would be required by the contemplated housing developments in that district. The reserve funds now reached a sum substantially greater than the total subscribed capital of the company, and more than half the total expenditure on capital account. The report and accounts were adopted.

Isle of Thanet Electric Supply Co., Ltd.

The annual meeting of this company was held on March 12th, Mr. A. R. Monks (chairman) presiding. In presenting the report and accounts (Electrical Review, March 14th, p. 508), the chairman said that over 500 additional consumers had been connected to the mains during the past year. While the electricity sold showed an increase over the previous year of 10 per cent., the revenue, due to the revision of tariffs and the increasing demand for electricity for heating purposes, showed an increase of under 6 per cent. Agitation was being carried on in Thanet with regard to the prices charged by the company, but taking into consideration the past financial results of the undertaking, particularly during the war period, and its limited tenure, this criticism was unwarranted. It should be pointed out that the rates paid to local councils, *viz.*, £6,296, were equivalent in a full year to 0.45d. per kWh sold. The report and accounts were adopted.

Dublin United Tramways Co., Ltd.

Mr. William Hewat (chairman), in the course of his address at the recent annual meeting, said that the past year was throughout one of continual anxiety for the directors and the management. There had been a further increase in the 'bus competition and the public was being catered for far in excess of its requirements, with inevitable loss to both forms of transport. Referring to the Electricity Board's offer to supply the company with electricity from the Shannon supply, the chairman said that they were left no option in the matter, but were required to change over from their own generating station to the Shannon supply, when the latter was ready to give the energy for their requirements. Arrangements were practically complete, and they were only waiting for the necessary plant to be installed in the new transformer station at Ringsend.

Croydon Cable Works, Ltd.

The *Financial Times* states that the company has entered into a provisional agreement with Acons Nominees, Ltd., for the sale to the latter of the whole of the issued capital of the company on the following terms: 20s. 6d. for each £1 first preference share; 17s. for each £1 second preference share; 12s. 6d. for each £1 third preference share; and 11s. for each £1 ordinary share. Mr. Kerr, a director, will retire, receiving £200 compensation, while Messrs. Bibby and Brooking will continue to act as directors. The agreement is conditional upon acceptance of the terms by 75 per cent. (or fewer at the option of the purchasers) of each class of shareholder by March 28th.

Prospectus.

North Metropolitan Electric Power Supply Co.—On Monday last this company published a prospectus offering for subscription £750,000 of 5½ per cent. debenture stock at par, ranking, with the exception of redemption date, with the existing 5½ per cent. stock (£350,000). The new stock is to be redeemed by 1966 by purchase at 102½ per cent. or under, or by annual drawings at 102½ per cent. The whole of the stock may be redeemed at six months' notice at the same price. The proceeds of the issue are to be devoted to the repayment of a bank loan and for the general development of the business. The prospectus mentioned that the company's sales for last year were about 200 million kWh. the gross revenue was £1,184,000, the net revenue £400,225, and the surplus, after meeting debenture interest, &c., £355,492. Owing to heavy over-subscription, the lists were closed very early on the morning of issue.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

The report for the year ended December 31st last states that the connections rose by 2?,667 h.p. to 739,355 h.p. The profit for the year was £876,351, as compared with £819,456 in 1928. From this, debenture interest is met and £175,000 is reserved for special depreciation and contingencies (against £150,000), and £75,000 for plant renewals and improvements (against £60,500). To the balance of £437,784 is added £80,653 brought forward, making £518,437. The final ordinary dividend is 3½ per cent., making 6 per cent. for the year (as for 1928), and £96,029 is carried forward. During the year £85,217 was charged against the reserve for plant renewals and improvements. Capital expenditure amounted to £243,480, representing mainly extensions of the distributing system. Meeting: March 25th.

Liverpool Overhead Railway Co.

The ordinary general meeting of this company was held on March 12th at Liverpool, Mr. M. H. Maxwell presiding. In presenting the report and accounts, the chairman said that fewer passengers had been carried, and revenue had declined, as compared with 1928. The falling off in the number of passengers was not large, but it was in the better paying classes. The rates payable on the line and stations had been increased approximately 500 per cent. The rating surveyor was taking the matter up, but they were not hopeful of any reduction in respect of the past year. The new station at the Gladstone Dock would be opened about May. The report and accounts were adopted.

Marco Refrigerators (1929), Ltd.

An extraordinary meeting has been called for March 24th to consider resolutions providing for the reorganisation of the company's capital. It is proposed to consolidate the 4,000,000 1s. shares into 200,000 shares of £1 each; and to reduce the capital to £130,000 in 12s. shares by returning to shareholders 8s. of each pound paid up. Thereafter the 12s. shares will each be divided into three 4s. shares and again consolidated into £1 shares. The capital is then to be restored to £200,000 by the creation of 70,000 £1 shares. The reason for the return of capital is that the amount received is in excess of the company's present requirements.

Cork Electric Supply Co., Ltd.

The company has announced that the Electricity Supply Board has decided to acquire compulsorily its electricity undertakings in the borough and rural district of Cork and the township of Queenstown, and has served notice specifying April 3rd next as the date on which these undertakings will be acquired. The shareholders will be advised at the general meeting as to the fair value to be paid for the undertakings and other particulars. In the meantime they are advised not to part with their shares. The tramways are not being taken over by the Board and will continue to be operated by the company.

Telegraph Construction & Maintenance Co., Ltd.

The report for the past year records a loss against a profit of £106,144 for 1928. A sum has been taken from the reserves to meet this and to give a balance of £77,801. To the latter amount £114,122 brought forward is added, making £191,923 available. The dividend is maintained at 10 per cent., free of tax, by a final distribution of 7½ per cent., and £102,283 remains to be carried forward. Last year £15,000 was transferred to reserve. The directors state that the works were not fully employed during the year owing to the lack of orders of any magnitude. Meeting: March 27th.

Bruce Peebles & Co., Ltd.

The directors recommend that a dividend at the rate of 7½ per cent., less tax, being the fixed preference dividend, be paid on the preference shares for the half-year to December 31st, 1929. As the profits for the year are not sufficient to meet the fixed preference dividend, the extra dividend of 2½ per cent., contingent on the profits of the year, will not be paid. The directors also recommend that a dividend of 2½ per cent., less tax, be paid on the ordinary shares for the year to that date. A transfer of £7,000 to profit and loss account from general reserve has been made, after which the balance on general reserve stands at £103,000.

International Telephone & Telegraph Corporation.

The directors, on March 13th, authorised an issue of capital stock of the Corporation without par value at an issue price of $50 per share, and the offer of such stock to the stockholders of record March 21st, 1930, for subscription by them in the ratio of 1 share for each 8 shares without par value registered in their name. A quarterly dividend of 50 cents per share payable April 15th, 1930, to stockholders of record March 21st has been declared.

Hendon Electric Supply Co., Ltd.

The report for 1929 shows that after meeting debenture interest and the interim ordinary dividend, &c., there is an available balance of £38,749, as compared with £39,811 in 1928. From this £9,125 is placed to repairs and renewals fund, £3,809 to reserve and £5,800 to income tax account. It is proposed to pay a final dividend of 2s. per share, free of tax, making 15 per cent. for the year, as for 1928, leaving £10,405 to be carried forward.

International Aluminium Co., Ltd.

The net profit for 1929 was £42,619, to which is added £9,198 brought forward, making £51,817. The preference dividend is paid, and the directors recommend that the balance of expenses relative to raising of capital amounting to £15,847 be written off, and that £7,500 be carried to reserve, leaving £11,235 to be carried forward.

Wellingborough Electric Supply Co., Ltd.

The total revenue for the year ended December 31st last was £20,736, as compared with £19,089 in 1928, and after making provision for depreciation, debenture interest, &c., there was a profit of £2,103, as against £1,874, to which is added £1,690 brought forward, making £3,794. The directors recommend the payment of a dividend of 5 per cent. (as for 1928), leaving £1,544 to be carried forward. The sales of electrical energy rose from 1,539,804 to 1,777,766 kWh.

Mersey Power Co.

The report for 1929 states that the profit was £94,230, as compared with £100,869 in the previous year. To this is added £17,081 brought forward, making £111,311. After meeting interest charges, it is proposed to pay 5 per cent. on the ordinary shares, as for 1928, to place £25,000 to reserve, and to carry forward £17,660. Meeting: March 25th.

The Baird Television Companies.

The scheme for the amalgamation of the Baird Television Development Co., Ltd., and the Baird International Television, Ltd., has now been published and is to be placed before the shareholders at a meeting on April 7th. The amalgamated company will be known as Baird Television, Ltd., and will have an authorised capital of £825,000 (£512,500 to be issued).

Tees Power Station Co., Ltd.

A profit of £118,270 (against £122,231) is shown in the accounts for the past year. After meeting debenture interest, it is proposed to pay a dividend of 5¾ per cent. (against 6 per cent. on smaller capital) and to carry forward £2,793. The capital has been increased and 20,000 shares have been allotted to the Newcastle-upon-Tyne Electric Supply Co. The paid-up capital is now £1,012,978.

County of Durham Electrical Power Distribution Co., Ltd.

The profit for the past year was £65,799 (against £59,299). After meeting debenture interest, &c., an ordinary dividend of 6 per cent. is recommended (as for 1928), leaving £1,546 to be carried forward.

Eastern Telegraph Co., Ltd.

The directors announce the payment of a dividend at the rate of 3½ per cent. per annum on the preference stock for the quarter ending March 31st.

Midland Electric Corporation for Power Distribution Ltd.

A final dividend of 5½ per cent., less tax, has been declared, making 8 per cent. for 1929 (as for 1928).

British Columbia Power Corporation.

A dividend of 50 cents per share has been declared on the class "A" shares for the quarter ending March 31st.

British Aluminium Co., Ltd.

The final dividend on the ordinary shares is 6 per cent, again making 10 per cent. for the year.

Northern Mexico Power and Development Co.

A dividend of 0.5 per cent. has been declared on the common stock for the quarter ending March 31st.

Vickers, Ltd.

The directors have declared a dividend for the year 1929 at the rate of 8 per cent. per annum on the ordinary shares.

Tyneside Investment Trust, Ltd.

A dividend at the rate of 5½ per cent. on the £1 ordinary shares is announced for the year ended January 31st last.

German Companies.

The *Bergmann Electricity Works Co.*, Berlin, is paying a dividend of 9 per cent. for the past year, as in 1927-28.

The *Emag Electricity Co.*, Frankfort-on-Main, proposes to increase its dividend from 8 per cent. to 9 per cent. for last year.

The *German Telephone Works and Cable Industry Co.*, Berlin, states that the degree of activity in 1928-29 was satisfactory, but selling prices for part of the manufactures were unfavourable. The accounts show net profits of 112,000 marks (87,000 marks in 1927-28), which sum has been carried forward.

Belgian Company.

The report of the *Société Belge pour la Fabrication des Câbles et Fils Electriques* states that it was not only possible to keep the various departments in full activity during the whole of 1929, but also to derive advantage from their modernisation and development, especially the cable branch. The net profits amount to 3,016,000 fr., and the dividend on the ordinary shares is 70.50 fr. per share on a capital of 4,250,000 fr.

Stocks and Shares.

TUESDAY EVENING.

THE outstanding feature in the Stock Exchange markets continues to be the strength shown by purely gilt-edged stocks. This is due to the continued ease in the money market, and to the expectation that a further reduction in the Bank Rate to 3½ per cent. cannot be long delayed. Hope looks further still, and talks about a 3 per cent. Bank Rate as likely to come into force within the comparatively near future. It is pointed out that the need for money has been severely curtailed by the shrinkage in prices, not only of stocks and shares, but of commodities and metals: of industries also. Then, there is the fact that trade, practically throughout the world, is pursuing a course so humdrum that neither enterprise nor initiative finds profitable employment for capital at the present time. From the purely Stock Exchange point of view, the prospect which this opens is one that points to higher levels for investment stocks of various grades, for, after a rise in gilt-edged issues, the disposition is for investment to go further afield, and to include in its purview those stocks and shares which fall into lower classes. Business is active in the Consol market, but, elsewhere, the volume of Stock Exchange business has not been swollen to any noticeable extent by the remarkable expansion in values which has already occurred, even within the past fortnight, in certain British Government securities, Corporation stocks and similar issues.

Gilt-edged Stocks on Offer.

Amongst the electrical stocks of front rank, though not falling into the charmed circle of trustee securities, is Central Electricity Board 5 per cent. stock, which came out at 97½, and can still be bought at 96½, with a full half year's interest payable on September 1st next. Its twin stock, North-West Midlands Joint Electricity Authority 5 per cent. stock, offered at 98½, can also be obtained at 96½, the first interest payment in this case being due on July 1st, when the broken amount of 35s. per cent. falls due. Both stocks are dated 1950-1970, and the yield on the money comes to £5 3s. 6d. per cent. outright, with a few pence more per cent. allowing for redemption. London Power 5 per cent. redeemable debenture stock costs 98, ex the dividend payable on April 1st. The yield on the money here is £5 2s. per cent. There is still £5,000 County of London 5 per cent. debenture stock, June and December interest, which can be bought at 99, and a similar amount of West Midlands Joint Electricity Authority 5 per cent. 1948-1968 stock is on offer at 96½, which yields £5 3s. 6d. per cent. on the money. In the Home Railway list of gilt-edged issues, about £3,000 London Electric 4 per cent. debenture is available at 77, January and July interest, to pay 5½ per cent. on the money. This stock is eligible for trustees, and so also is the same company's 4 per cent. preference, of which £2,000 is offered at 71½, giving a yield of £5 12s. per cent. on the money.

Traction Issues.

In the Home Railway ordinary stocks, Metropolitans have weakened to 62½, but Districts are unchanged at 72½, and Underground Electric shares show no alteration at 22s. 6d. At 106, the income bonds are a point lower. The 5 per cent. debenture, however, rose to 97. Investment demand has not yet penetrated into the Home Railway market for ordinary stocks, although the electrification programme of the Southern Railway causes the company's issues to be regarded with favour, and directs attention to them. Of the London Tramway descriptions, London & Suburban Traction preference have fallen back to 10s., London United Tramways preference have changed hands lately, at about 4s., and London and Suburban Traction ordinary at 2s. 6d. Business has been done during the past few days in Metropolitan Electric Tramways 4½ per cent. debenture stock at 75½. The company's 5 per cent. debenture stock was dealt in, about a week ago, at 72. British Electric Traction deferred moved up 50 points, to 1,6'0. Amongst the foreign tramway shares, La Plata preference have gone back to 15s., and the ordinary have become a more or less nominal market at 1s. middle.

Home Electricity Supply.

In Home Electricity shares, the quotable alterations are few and far between. At the Kensington & Knightsbridge Electric meeting last week, the chairman, Colonel R. E. Crompton, mentioned that 69 per cent. of the company's sales in 1924 were represented by lighting, but that, in last year's report, less than half that percentage was shown to have been supplied for the same purpose. The price of the shares is about 26s. 6d., the figure at which most of the other shares in the London Electric group now stand. The North Metropolitan Electric Power Company has made an issue of £750,000 5 per cent. debenture stock offered at par, redeemable by 1966. The subscription-lists closed five minutes after they opened. Clyde Valleys are a shade harder. Last year's dividend rate, making 8 per cent. for the year, is repeated. Egham & Staines strengthened to 34s. 3d. Isle of Thanet ordinary are 30s.; the preference eased off to 24s. Northamptons remain at 42s. 9d., Richmond (Surrey) at 44s. 6d. Yorkshire advanced to 32s. 6d. British Power & Light are a shade better at 11s., and the two Atlas shares stand at 26s., and 24s. for ordinary

and preference, respectively. No change occurred in Newcastle-upon-Tyne Electric Supply shares on the issue of a report which shows that the profits of £876,351 in 1929 were about £57,000 higher than those in the previous twelve months. The ordinary dividend is maintained at 6 per cent. on an enlarged capital. The price of the ordinary shares is 23s. 9d., at which the yield on the money comes to a little over 5 per cent. The 7 per cent preference at 25s. 6d. offer a return of 5½ per cent. The Midland Electric Corporation for Power Distribution has declared a dividend of 5½ per cent., making 8 per cent. for the year, the same as that for 1928, and the price of the shares is unchanged at 32s. 6d., the yield, as our tables show, being £4 18s. 6d., or actually rather more when allowance is made for inclusion of the dividend in the price.

The County of London Company has declared a dividend of 8 per cent., making 11 per cent. for the year. This goes against 10 per cent. in the previous year. The increase is regarded as being very satisfactory. The price of the old shares is unchanged; that of the new shares has risen to 6s. 6d. premium.

Dollar Stocks.

The animation of the shares of the Hydro-Electric Company, of which mention was made here last week, is still a feature of the American industrial market. The price rose to 47, but gave way to 46¼, taking with it International Holdings, which slipped back to 6, the latter price showing a fall of ¼ on the week. The Hydro-Electric has issued its third annual report, showing a net income for 1929 of nearly seven million dollars, against a little over one million dollars in the previous twelve months. A dividend of one dollar was paid on the common shares for 1929, and a quarterly dividend of 50 cents has been declared in respect of the current twelve months. These figures had the effect of directing attention to various other American utility issues, though the prices have changed comparatively little on the week. Brazilian Tractions drooped to 40½, which is the more surprising in view of the fact that Brazilian Government, and other Brazilian issues, have been advancing in price. Of the light and power shares, Montreals at 137½ are 1 down. Shawinigan Water eased off to 76. Power Corporation of Canada are 74½, and Pennsylvanias 87½. Amongst other dollar issues Barcelona Tractions at 26½ are 1½ better on the declaration of the dividend of 1 per cent. The preference stock remains at 145. In the Mexican group, a gain of 8½ points in Mexican Light & Power shares raised the price to 78½, and Mexico Trams strengthened to 22½. Yet the latter company's 5 per cent. bonds shed 2 points, receding to 64½. Rio Tramways 5 per cent. first mortgage bonds are better at 99½.

Cables and Wireless.

The principal strength shown in our lists this week is to be found in the trio of Cables & Wireless stocks. The chief gain has been secured by the 5½ per cent. preference, which has risen to 96½, this being, it is well to remember, ex the dividend recently deducted from the price. The ordinary stock, after our tables were made up, touched 65, while the "B" stock barely held its quoted price of 30. Judged by the character of the buying, it would almost look as though a rough idea had been obtained of what the figures are likely to show when they are published in two or three months' time. The market was swept bare of stock, and the price of the "A" ordinary rose 5 points in a shorter number of hours. Globe Telegraph and Trust ordinary recovered their 10s. fall of last week, and are now quoted at 21½. There are no changes in the Anglo-American group. Automatic Telephones are 37s. 6d. Jutland Telephone 5½ per cent. bonds at 10 are ex dividend. American Telephone and Telegraph at 245 is 5 points lower, notwithstanding the exceedingly good report to which reference was made here last week. International Telephone & Telegraphs have gone back 5 to 67½.

Manufacturing Shares.

British Insulated Cables announces a record level of profits for last year at £686,000. The dividend, as previously announced, remains at 15 per cent., and the price of the shares is steady at 73s. 9d. G.E.C. 6½ per cent. preference came on offer, and fell 1s. to 23s., the company's 6½ per cent. "B" preference being quoted at 25s. 6d. Siemens are a dull market, and business goes on regularly in the neighbourhood of 22s. 6d. to 23s. In the iron and steel and allied group, Babcock & Wilcox lost a few pence at 59s. 6d. Vickers are steady at 8s., and, generally, this section is idle.

Henleys are slightly better at 6 1/16. There has been a little activity in Telephone Rentals, Limited, the price being 3s. 6d. middle, while that of Telephone Manufacturing (1929), Ltd., is about 9d. per share. The American General Electric is stated to have been attempting to obtain control of the Ericsson Telephone Company, whose successful operations for last year have already been mentioned here. The majority of Ericsson "A" shares are said to be still in Swedish hands, and it is believed that these latter are by no means anxious to let the Americans acquire control.

Rubber shares are languid, and nothing of fresh interest has occurred either in the Stock Exchange or the Mincing Lane markets.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Approx. Dividend. 1927.	1928.	Price Mar. 18 1929.	Rise or fall	Yield p.c.
Bournemouth and Poole	£ 1	15	15	8	—	4 18 0
Brompton Ordinary	1	8½	8½	25/6	—	5 9 10
Charing Cross Ordinary	1	8½	8½	25/6	—	5 7 8
do. do. 4½% Pref.	1	4½	4½	17/-	—	5 6 0
Chelsea	1	8¾	8¾	25/-	—	5 12 0
City of London	1	10	10	32/-	—	4 7 6
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	35/-	—	4 11 5
County of London	1	7	10	44/4	—	4 10 0
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Edmundson's 7% Pref.	1	7	7	24/-	—	5 18 9
Elec. Supply Corporation	1	11	11	45/9	—	4 18 7
Kensington Ordinary	1	8	8	26/6	—	5 5 8
Lancs. Light and Power	1	7½	7½	27/	—	5 11 1
London Electric	1	8½	9	27/-	—	5 3 8
Metropolitan	1	9	10	38/9	—	5 0 0
do. 4½% Pref.	1	4½	4½	17/-	—	5 6 0
Midland Counties	1	6½	7	27/-	—	5 3 8
Mid. Elec. Power	1	15	8	32/6	—	4 18 6
Newcastle-on-Tyne Ordinary	1	6	6	28/9	—	5 1 1
do. 7% Pref.	1	7	7	25/6	—	5 9 10
Notting Hill 6% Pref.	10	6	6	10½	—	5 11 4
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 9 1
St. James' and Pall Mall	1	8	8	26/-	—	5 7 8
Scottish Power	1	8	8	29/-	—	5 6 8
South London	1	8½	8½	27/-	—	5 3 8
Urban Ordinary	1	7	7	33/9	—	4 2 10
Westminster Ordinary	1	8½	8½	25/-xd	—	5 13 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	24/3	+3d.	6 3 8
Yorkshire Elec.	1	8	8	32/6	+6d.	4 18 6

Home Rails.

		Nom.					
Central London Ord. Assented	Stock	£ 4	4	73	—	5 9 7
Metropolitan	,	8½	4	62½	−½	6 8 0
do. District	,,	4	5	72½	—	6 18 0
Underground Electric	£1	7	8	22/6	—	7 2 3
do. do. Income	Bonds	6	6	106	−1	5 13 1

Telegraphs and Telephones.

		Nom.					
Anglo-Am. Tel. Pref.	Stock	£ 6	6	101½	—	5 18 3
do. Def.	,,	1½	1½	34½	—	6 4 0
Automatic Telephone	1	10	12½	37/6	—	6 13 4
Cables & Wireless 5½ Pref.	Stock	—	5½	96½	+4	5 14 0
do. A 7½ Ord.	,,	—	—	62½	+2	... ...
do. B Ord.	,,	—	—	30	+1½	... ...
Globe Tel. and T. Ord.	10	10	10	21½	+½	*4 18 0
do. do. Pref.	10	6	6	11½	—	5 7 10
Great Northern Tel.	10	20	20	80½	—	6 11 2
Marconi-Marine	1	12½	15	2 7/8	—	6 17
Oriental Telephone Ord	1	12	12	2 1/8	—	*4 5

Home and Foreign Trams, &c.

		Nom.					
Anglo-Arg. Trams First Pref.	£ 5	5½	5½	8	—	9 8 4
do. do. 2nd Pref.	5	6	6	8 1/16	—	9 16 0
do. do. 5% Deb.	Stock	5	5	70½	—	7 1 10
British Electric Traction Def. Ord.	,,	5	5	1600	+50	... ...
do. do. Pref. Ord.	,,	8	8	124½	—	6 8 6
Brazil Traction	100	7	8	40½	−½	4 19 0
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	91½	—	5 9 8
London & Sub. Trac. 5% Pref.	1	Nil	Nil	10/-	—	... ...
London United Tram Deb.	Stock	4	4	53½	—	7 12 4
Mexico Trams, 5% Bonds	—	5	5	64½	−2	7 15 0
Mexican Light Common	100	Nil	Nil	78½	+8½	... ...
do. 7% Pref.	100	7	7	75½	—	9 5 6
do. 1st Bonds	—	5	5	76	+1½	6 11 7
Victoria Falls Ord.	£ 1	15	15	2 7/8	−1/16	5 4 4
Yorkshire (West Riding)		Nil	Nil	4/3	−9d.	... ...

Manufacturing Companies.

		Nom.					
Assoc. Elec. Ord.	£ 1	6	—	35/-	—	4 16 0
Babcock & Wilcox	1	12	15	59/6	−6d.	*5 0 10
British Aluminium Ord.	1	10	10	43/3	—	*4 12 6
British Elec. Transformer Pref.	1	7	7	10/-	—	... ...
British Insulated Ord.	1	15	15	3½	—	4 1 7
Brush Ord.	Stock	10	10	126½	—	7 18 1
Callenders	1	15	15	8 7/8	—	4 4 3
do. 6½% Pref.	1	6½	6½	29/9	—	5 9 5
Crompton Parkinson Ord.	£/-	—	20	22 6	—	6 13 4
do. 8% Pref.	1	8	8	35/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	7 1 2
do. 5% Deb.	Stock	5	5	84½	—	5 18 4
Electric Construction	1	7½	6½	11/3	—	9 15 6
Enfield Cable Ord.	1	20	20	4½	—	4 4 2
English Electric	1	Nil	Nil	8/9	—	... ...
do. do. Pref.	1	8	Nil	7/6	—	... ...
Gen. Elec. Pref.	1	6½	6½	23/-	−1/-	5 13 1
do. Ord.	1	10	10	9 1/16	—	4 6 7
Henley	1	35	30	6 1/16	+1/16	4 19 0
do. 4½% Pref.	5	4½	4½	4½	—	5 0 0
India-Rubber	1	Nil	Nil	10/-	—	... ...
Johnson & Phillips	1	10	—	9*/3	—	5 10 5
Siemens Ord.	1	7½	7½	23 9	−1/16	6 6 2
Telegraph Construction	12	10	10	25	—	*4 16 2

*Dividends paid free of Income Tax.

Our Foreign Electrical Trade.

Electrical Exports and Imports during February.

HAVING regard to the fact that February was a short month the statistics of electrical trade included in the Board of Trade returns are satisfactory. The difference in the number of days in January and February is sufficient explanation of the decline of £89,687 in the export total, while in comparison with February, 1929, the figure showed a substantial increase. Comparing the exports with those of January, it will be seen that the greatest decrease occurred in the case of telegraph and telephone instruments and apparatus which fell by £62,079; there was also a decline of £41,375 in the exports of non-submarine telegraph and telephone wires and cables. On the other hand submarine cables rose by £26,640. The machinery section as a whole improved by about £6,000, the fall in exports of "other motors and generators" being more than compensated for by rises in the other two items. The figure for unenumerated machinery reached a very high level. In the goods and apparatus section the only changes of any magnitude were decreases of the order of £15,000 in unenumerated goods and glow lamps. In comparison with February, 1929, there was a considerable advance (£114,053) in the case of insulated wires and cables, and unenumerated goods were £89,074 up. The machinery section made a good showing, being about £73,000 above the February, 1929, level. The principal declines occurred in the exports of telegraph and telephone apparatus (£82,051), non-submarine telegraph and telephone wires and cables (£22,372), and batteries and accumulators (£26,948).

The imports, after keeping at £900,000 for four months (they went to over a million in October) fell to about £800,000; even at that they were over a quarter of a million higher than in February, 1929. The principal decreases as compared with January were recorded against glow lamps (£38,258), telegraph and telephone apparatus (£31,680), and machinery (£25,449). There were actually only two increases, neither of any magnitude. The most remarkable feature of the comparison with February, 1929, is the increase of £205,596 in the imports of meters and instruments; this item assumed the leading position in the import list in January, and already this year the value of £449,764 has been reached. Nearly all the other items showed an advance, but in the telegraph and telephone section there was a fall of £39,000.

Re-exports were doubled as compared with January, due almost entirely to a jump of over £60,000 in the item "telegraph and telephone instruments and apparatus." Batteries and accumulators were a little above the January figures, and as compared with February last year showed a rise of £18,722.

The advance in imports during the first two months of the year was considerably greater than the rise in exports. The inset table shows the distribution of our electrical machinery exports during February by weights and values, and compares the figures with those for February, 1929. The increase of £72,917 in the total value of machinery exports was satisfactory. The fact that South America increased its share by £30,488 is an encouraging sign, and it looks as though the European market is becoming of greater importance. South Africa has so far shown a considerable improvement this year. The decline in the exports to Japan is a continuation of a tendency which has been noticeable for some time.

Destination.	Quantities. Feb., 1929. Tons.	Feb., 1930 Tons.	Inc. or dec. Tons.	Values. Feb., 1929. £	Feb., 1930. £	Inc. or dec. £
Europe	455	467	+ 12	103,512	110,109	+ 6,597
Japan	90	27	− 63	17,317	6,963	−10,354
South America ...	163	422	+259	35,897	66,385	+30,488
South Africa ...	142	327	+185	28,466	44,256	+15,790
British India ...	904	757	−147	124,916	121,097	− 3,819
Australia	714	590	−124	97,330	90,481	− 6,849
New Zealand ...	181	230	+ 49	22,617	32,673	+10,056
Canada	81	133	+ 52	13,603	16,009	+ 2,406
Other countries ...	368	684	+316	68,119	96,721	+28,602
Totals ...	3,098	3,637	+539	£511,777	£584,694	+£72,917

	Exports. Electrical exports for Feb. 1930.	Inc. or dec. as compared with Jan. 1930.	Inc. or dec. as compared with Feb. 1929.	Imports. Electrical imports for Feb. 1930.	Inc. or dec. as compared with Jan. 1930.	Inc. or dec. as compared with Feb. 1929.	Re-Exports. Electrical re-exports for Feb. 1930.	Inc. or dec. as compared with Jan. 1930.	Inc. or dec as compared with Feb. 1929.
Electrical goods and apparatus (unenumerated)	£267,281	−£14,764	+ £89,074	£143,614	− £13,620	+ £23,074	£10,580	− £1,317	+£3,316
Insulated wires and cables ...	333,143	+ 5,101	+ 114,053	95,118	− 2 880	+ 38,637	676	− 19	+ 136
Glow lamps	42,042	− 15,288	− 1,951	36,040	− 38,258	+ 15,118	1,493	+ 377	+ 628
Arc lamps and parts	4.822	+ 2,856	+ 2,250	3,240	+ 781	+ 2 220	2	+ 2	− 151
Batteries and accumulators ...	86.608	− 1,320	− 26,948	51.898	− 7,717	+ 8,093	18,929	+ 3,002	+ 18,722
Meters and instruments ...	26,595	− 1,226	− 192	223 433	− 2,898	+ 205,596	789	− 242	+ 277
Carbons	208	− 677	− 469	15,561	− 3,691	+ 2,568	810	+ 774	+ 586
Switchboards (not telegraph or telephone)	9.957	+ 6,196	+ 7,536	124	+ 78	− 708	10	+ 10	+ 10
Electrical Machinery—									
Electrical machinery (unenumerated)	366,897	+ 26.568	+ 42,649	152,902	− 25,449	+ 32,122	11,197	+ 3,114	+ 2,573
Railway and tramway motors	30.997	+ 19 583	− 727	—	—	—	—	—	—
Other motors and generators...	186,800	− 39 902	+ 30,995	—	—	—	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	57,122	− 41,375	− 22,372	3,536	− 966	− 4,956	—	—	− 45
Submarine telegraph and telephone cable...	47,135	+ 26,640	+ 41,152	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	195.757	− 62.079	− 82,051	70,462	− 31,680	− 34,652	68,974	+ 60,681	+ 66,008
Totals	£1,655,364	−£89,687	+ £192.999	£795,928	− £126.300	+£287,112	£113,460	+£66,382	+£92,060
			Exports			Imports			Re-Exports
Inc. for two months			+ 323,749			+ 611,245			+ 119,160

Trade with South America.

Views and Recommendations of the D'Abernon Mission.

THE Department of Overseas Trade has made available the report of the British Economic Mission which made a visit of investigation to Argentina, Brazil, and Uruguay last year.* It may be recalled that the Mission was led by Lord D'Abernon, while the members were Mr. W. Howard-Williams, Sir William Clare Lees, and Mr. Julian J. Piggott, Mr. H. W. Wiswould acting as secretary. The terms of reference given to the Mission were "To consider Anglo-Argentine and Anglo-Brazilian relations, industrial, commercial and financial, with a view to their development to the mutual advantage of the countries respectively concerned, with full powers to investigate every aspect of trade and industry." The Mission spent five weeks in South America, and while there was asked to extend its inquiries to Uruguay.

In introducing its report, the Mission says that it has endeavoured to set forth the position according to its view "without prejudice, favour, or reticence." The potentialities for British trade in South America are very great; the present volume of trade, although considerable, is only a small proportion of the probable future trade. British capital has been invested there to the extent of over 1,000 millions sterling, and British capitalists have found favour in South America, probably because they are in closer touch with the requirements than are our merchants and manufacturers. Moreover, Great Britain enjoys the confidence of the countries visited by reason of the quality of her goods and the honourable reputation of British merchants established in South America. It is believed that this is not generally appreciated in this country, although it is also realised that we labour under severe handicaps from which our competitors are free. Since the beginning of the war we have undoubtedly lost ground, especially in new departures, although in some old-established branches we have retained our original position. The principal criticism of British commercial practice is our apparent incapacity to accommodate ourselves to local circumstances. It is also alleged that our competitors look farther ahead, organise more, and take larger risks. British communication and shipping services are also said to have fallen behind those of competitors. The selection of diplomatic representatives is not conducted on the correct lines; more regard should be paid to active economic development. There should also be an adequate supply of young Englishmen with a practical knowledge of Spanish and Portuguese, and facilities for learning these languages should be developed.

Turning from criticism, the Mission presents another aspect of British activities in South America. A glowing tribute is paid to the good work accomplished by British companies in Argentina, particularly in the case of railways. Argentine opinion is unanimous that the services have been of inestimable advantage to the Republic and could not be in better hands. In their respective spheres, the same may be said for other British enterprises. The Mission is of the opinion that we have made no endeavour to use the question of Customs duties as a means of obtaining more favourable treatment of our goods. A real advantage could be derived by us from negotiating on a reciprocal basis, either through the instrumentality of block purchases, or, still better, by stipulating concessions in return for advantages offered by us as consumers. To show that reciprocal agreements are possible, the Mission mentions that concluded during its visit by which each country undertook to buy up to £8,700,000 worth of the other's products.

Argentina.

The report proceeds to deal in some detail with each of the countries visited, commencing with Argentina. The close friendship between Great Britain and this Republic is stressed, and it is pointed out that the two countries are economically complementary. Argentina leads the rest of the South American countries in practically every direction, and it is no exaggeration to say that if she is to maintain that leadership it will be by British co-operation and through the further investment of British capital. Argentina is very largely dependent upon the British consumer and his purchasing power. In 1928 she exported to England goods valued at £76,788,817, while she imported £31,209,978 worth of British goods. In this way Argentina pays the interest on British investments with products which this capital itself has been instrumental in creating. Enlightened Argentine opinion realises that the Republic cannot permanently rely on the open British market, still less on a larger volume of trade, unless she offers us facilities for doing a reciprocal trade. On the other hand, Great Britain cannot permanently rely on the unassailable security and yield of her capital in Argentina, especially that in the great public services, unless the direction and administration of that capital follows a consistent policy of association with Argentine national needs and aspirations.

Further discussing the question of capital, the report mentions the desirability of Argentine participation in British companies operating in the Republic, and in this connection says that the British income tax upon the profits of British companies in Argentina acts as a deterrent. It also recommends the freeing of Argentine loans raised in London from the two per cent. stamp duty now levied, which adversely affects financial business and has an undoubted repercussion on British exports.

With regard to trade it is shown that since the war Great Britain has ceded first place in the import list to the United States, and this is attributed mainly to the development by the latter of new lines in which we have taken an insignificant share. Several of these lines are specifically mentioned, including electrical appliances, radio apparatus, and domestic refrigerators. To a smaller extent British trade has suffered from local production sheltering behind high import duties; this has led, however, to the establishment of local factories by British concerns in some cases. The Mission expresses its gratification at the Government's decision to participate in the British Empire Trade Exhibiton, Buenos Aires, next year. Attention is devoted to an exposition of the very large proportion of Argentine agricultural products purchased by the United Kingdom, and the report then proceeds to a survey of the part played by British capital in Argentine transport and communications. It is mentioned that the tramway and subway system in Buenos Aires, which carries about 700 million passengers yearly, is British to the extent of 74 per cent. of its capital; also that the British were pioneers of submarine cable communication with the River Plate ports and provided Buenos Aires and the provincial towns with their telephone systems and operated them until they were recently acquired by American interests. As in the case of the trade in new commodities, so with the newer forms of transport and communications, British enterprise has had to see its competitors take the leading share. Fortunately for British industry the railways have resisted proposals for the transfer of ownership and, with Government and public encouragement, are proceeding with extensions and reconstruction on a large scale. As has been mentioned, the telephone business has passed to American hands and Great Britain has taken only a minor share in radio communication between Argentina and Europe. Mention is made of the long-standing dispute between the Buenos Aires Municipality and the Anglo-Argentine Tramways Co. with regard to the construction of subways in the city. The company's proposals involve a 15 cents fare basis, but the Municipality has given it twelve months' option to proceed with the construction of the most important subways on a 10 cents basis. Roads, shipping, aviation, &c., are also given attention.

Brazil.

The existing commercial relations between this country and Brazil are not altogether satisfactory. Already British goods are subjected to high protective duties which will probably be increased unless the Brazilian authorities are restrained by new arguments or inducements. On the other hand, Brazil complains that Great Britain is a poor customer, being seventh in the list of importers of Brazilian goods. The potentialities of future development are great, and this country is the largest probable customer for certain products which Brazil is endeavouring to export in larger quantities. The "education" of the Brazilians has proceeded rapidly, and they possess a high public spirit. Two of the Republic's chief needs at present are capital and improved means of transport. The Mission thinks that Great Britain should sympathetically consider the removal of the duty upon coffee—Brazil's largest exported product—should there be any sign of reciprocation upon Brazil's part. This country occupies second place in the list of exporters to the Republic, but as in Argentina we are not supplying the demand for new commodities. Although at present there are no signs that Brazil intends to revise the tariff conceived in 1900, which is one of the highest in the world, the Mission says that the question cannot be postponed indefinitely. The *ad valorem* duties are said to operate very unfairly to honest traders. Until the war nearly all foreign capital came from this country, and British investments in Brazil are estimated at about £200,000,000. Since the war, however, new capital has been obtained mainly in the United States, and American capital has shown a readiness to acquire British concerns in the Republic. Dealing with railways, the report says that electricity is bound to play a large part in railway development; only one important line has been electrified, but further schemes are projected or in hand.

Uruguay.

Conditions in Uruguay are given brief treatment. It is shown that, although Great Britain is that country's leading customer, in the import list we are ranked second to the

* H.M. Stationery Office, 1s. net.

United States. The necessity for separate representation is urged, and it is said that scope undoubtedly exists for British engineering interests. The railways, the State electricity works, and other buyers are very well disposed towards British machinery and materials. Great Britain admits Uruguayan products without restriction and the time has come for a frank and full discussion of the question of reciprocal advantages.

Meeting the Requirements.

The next chapter of the report discusses the various ways in which British production and salesmanship should be adjusted to the requirements of the South American markets. It is said that British manufacturers are still prone to sell the customer what they think he ought to have—not what he wants. Although the quality of British goods helps us to maintain a predominant place, there is a demand for goods of a lower quality to which attention should be given. This leads to the question of prices in which British goods labour under difficulties. In selling, British manufacturers are often too haphazard; the market is not properly studied by principals, and sometimes agents are appointed without discrimination. Much better use should be made of the information which is available from the Department of Overseas Trade and other sources, and time and money should not be begrudged for a severely intellectual study of market conditions. The South American people are very susceptible to advertisements, and in this direction we have not kept pace with our competitors. Where the business justifies it, the best form of marketing organisation is direct representation by one or more branches or agents whose sole duty is to sell the particular commodity produced by a given firm. If this cannot be done individually, it might be possible for several firms in association to do it. The least satisfactory method is the multiple agency by which products of all kinds are handled by a single agent. The banks, the British Chambers of Commerce, and the Department of Overseas Trade are all willing to assist with information in the appointment of agents, but it is better for these to be selected by principals on a visit to the market. When appointed, agents should receive the full support of the home firm. Good service, including delivery from stock and quick repairs and replacements, is essential. It is said that unpunctuality in delivery on the part of British manufacturers has been an important cause of the loss of orders. The Mission's studies have led it to the conclusion that combination of manufacturers is necessary to ensure an efficient marketing system on account of the great expenditure which is required. Combined selling by British traders in a small number of instances has been very successful. "The future lies with the large selling unit, and however grave the difficulties, however deeply rooted the characteristics, the so-called 'individualism,' which prevent British manufacturers in particular from combining in business matters, it is essential that effective methods of co-operation should be devised." The report points to the necessity for lower freight rates, even if this means slower service. Business with South America necessitates the use of the metric system. Lower communication charges are also said to be desirable, the present high rates acting as a handicap to British traders.

Fig. 1.—Current Divertor.

The final chapter of the report deals with the commercial importance of cultural influences, particular reference being made to the spreading of foreign national culture by means of special associations, through educational institutions, literature, &c. In this respect several countries who are our commercial competitors have done far more than we have.

A New Combustion Process.

The discovery of a new combustion process which makes it possible for the first time to manufacture fuel at the place and time of consumption is announced by the Wasley Process Combustion Corporation. The new method uses hydrogen to produce heat, with a great saving in the cost of fuel. Hydrogen in gaseous form is produced from superheated steam. Coal or oil is used only to create steam and, once started, the system is continuous and entirely automatic. When the steam has become super-heated it is injected at or near the point of combustion.—*Reuter's Trade Service.*

The Vienna-Baden Electric Railway.

The New Passenger Coaches of the Vienna-Baden Inter-Urban Electric Line.*

THE traffic on the Vienna-Baden 18-mile line was converted to electrical operation in 1906-7. The line starts in the centre of Vienna, and passes along the local tramway track through the suburbs before traversing about 13 miles of open country, finally reaching the local tramway lines of Baden. The tramway sections were operated at 500-700 volts d.c., whilst the country stretch was operated off an 11,000-volt 16⅔-cycle single-phase a.c. supply, reduced to 550-800 volts in ten transformer sub-stations along the line.

When it became necessary to overhaul the rolling stock, various modifications were considered, but it was decided to retain the same combined d.c. and a.c. operation—using the existing cars for the local tramway lines, and building 12 new and improved cars in addition. The new cars are of the combined motor and passenger-carrying type shown in fig. 2, and are handsomely fitted to meet the growing road coach competition. The leading particulars of these cars are as follows:—Width of track, 4 ft. 8½ in.; length over buffers, 50 ft.; width of coach, 7 ft. 8 in.; wheel base, 27 ft.; wheel diameter, 33½ in.; gear ratio, 1: 5.466; seating capacity, 42; weight complete with passengers, 32 tons; running speed, 31 m.p.h.; average speed of the express cars, 17½ m.p.h.; operating voltage, 550-700 d.c. and 750 V s.p. a.c., 16⅔ cycles; number of motors, 4, each having 6 salient main poles and 6 inter-poles, but no compensating winding. They are self-ventilated by fans. The one-hour rating of the motors is 90 h.p. at 375 volts, 1,150 r.p.m. on a.c. and 98 h.p. at 375 volts, 1,250 r.p.m. on d.c., and the continuous rating is 67 b.h.p., at 375 volts, 1,300 r.p.m. on a.c., and 80 b.h.p. at 375 volts, 1,450 r.p.m. on d.c. Weight of the motors, 1.7 tons; weight of the complete electrical equipment, 10.6 tons. The motors drive through pinions at both ends of the shaft.

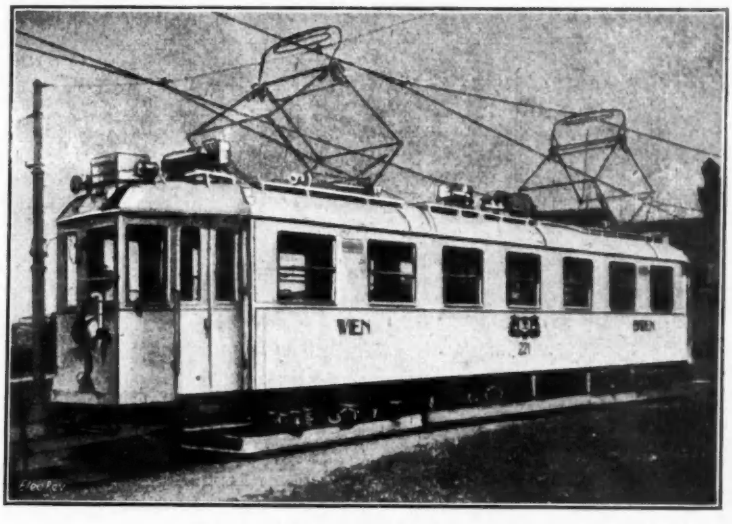


Fig. 2.—Vienna-Baden Railway Car.

An ingenious device is adopted to ensure the correct commutating pole excitation on both d.c. and a.c. This is shown in fig. 1. The commutating pole winding is shunted by an ordinary divertor, R_1, and also by a second divertor, R_2, in series with a choking coil, D. This second divertor is only effective on d.c., whilst on a.c. it is prevented from diverting much current by the inductive action of D.

* L. Mandich, *E.T.Z.*, 31.10.29.

Production of Tantalum.

Tantalum, which absorbs 740 times its volume of hydrogen gas, successfully resists attack by the strongest mineral acids, and changes alternating into direct current, is, according to *Science*, finding greater use for dental instruments, surgical tools, pen points, hypodermic needles, and acid-proof pumps.

Tantalum was used for electric lamp filaments in 1906, but until a few years ago it had been very rare; it is now rarer than gold. The production in 1928 was only 35,000 pounds.

Because it absorbs gas so well, it is used for the metal parts of vacuum tubes. Although there are other substances which, when used as an electrode of an electrolytic cell, permit the passage of electricity in only one direction, tantalum is the best. Electrolytic rectifiers for charging storage batteries contain it. Aqua regia, which readily dissolves both platinum and gold, has no action on this metal; hydrofluoric acid alone is successful in attacking it, and strong alkalies are ineffective.

Tantalum can be cold-rolled to a sheet one thousandth of an inch thick. It is found in the Black Hills of South Dakota and in Australia.

An Electric Thermal-storage Scheme.

The installation of the Northern Chromium Co., Ltd., is claimed to be one of the first thermal-storage systems, if not the first, to be applied to industrial heating in Great Britain.

THE many advantages, both to the consumer and the supply authority, of utilising electrical energy during off-peak load periods are gradually being recognised throughout the country, and the demand for the cheap power obtainable during these periods is happily increasing. At the present time the field of application is somewhat restricted, and probably the largest demand is made by thermal-storage systems. One of the first of these to be applied in Great Britain to industrial heating, if not actually the very first, is used in connection with the extensive plant recently installed for the Northern Chromium Co., Ltd., for chromium-plating by a new process, for which it has the sole rights in Great Britain.

In all, there is a total of 24 large tanks, which have to be maintained at temperatures varying between 70 deg. F. and 140 deg. F. Fig. 1 is a view of the plating room, showing some of the tanks. The tanks include chromium-plating tanks, hot-sawdust tanks, hot-water tanks, degreasing tanks, and various acid baths used for copper, nickel, and aluminium plating. Each tank is fitted with a heating coil made of steel or lead, depending on the nature of the electrolyte, and this coil is connected through valves on the inlet and outlet sides to hot-water mains which run round the building. One of these valves is a check valve, and is usually fully open, regulation being carried out with the other valve. The whole system is efficiently lagged, and the supply of hot water is taken from the large thermal-storage cylinder installed in a pit outside the main building. This cylinder, fig. 3, which is 18 ft. long by 8 ft. in diameter, holds 5,650 gallons of water, and is heated by immersion heaters of a total capacity of 120 kW, supplied by Messrs. A. Reyrolle & Co., Ltd., and arranged in four 30-kW banks. Each bank consists of nine 3.3-kW heating units mounted on a common flange-plate, fig. 2, with their connections brought out to terminals on a set of four circular bus-bars. The supply is 3-phase at 440 volts, 40 cycles, and three of the bus-bars are connected to the outers, while the fourth forms a star point. The heating units are so arranged that the load is equally divided between the three phases. Fig. 4 is a close-up view of one of the 30-kW heater banks, with the end cover removed, showing the arrangement of bus-bars and the method of connecting the heater units and the incoming supply leads to the bars.

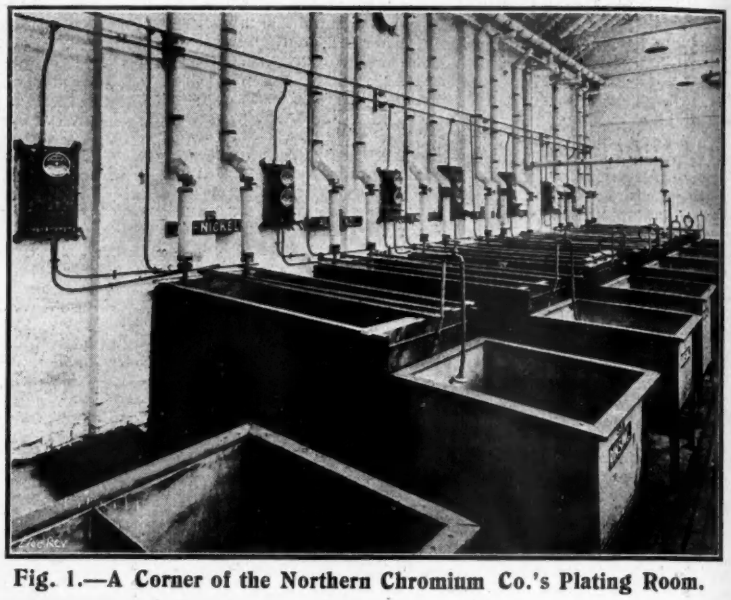


Fig. 1.—A Corner of the Northern Chromium Co.'s Plating Room.

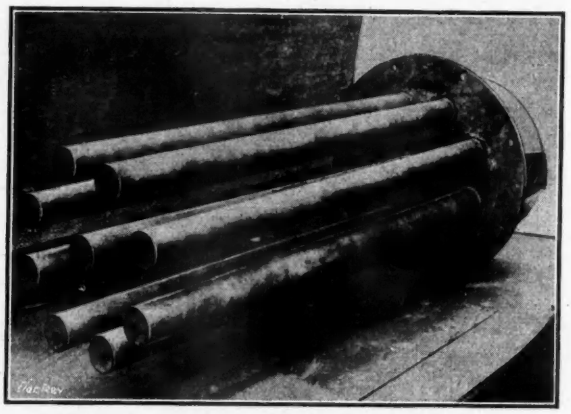


Fig. 2.—A Heater Bank out of Cylinder.

Energy for heating the cylinder is supplied at special rates, during the night hours only, from the mains of the Newcastle-upon-Tyne Electric Supply Co., Ltd. Current is automatically switched on by a time-switch at 7.30 p.m., and it continues to flow until the water in the main cylinder reaches a temperature of 220 deg. F., when it is switched off by a thermostat. In the morning the main stop-valve is opened, and a small circulating pump is started up, to pump hot water at a temperature of 220 deg. F. round the heating system, thus rendering heat energy immediately available for heating up the various tanks required for the day's work. At the end of the day the water is at a temperature of 140 deg. F., which implies a total heat storage equivalent to 1,320 kWh. It has been found that the majority of the tanks can be brought up to the required temperature within three-quarters of an hour after starting up the circulating pump. Fig. 5 is a view of the hot-water circulating pumps. One pump only is in service at one time; the other is a stand-by. One of the thermostats for the switching control is shown just behind the coupling of the far pump.

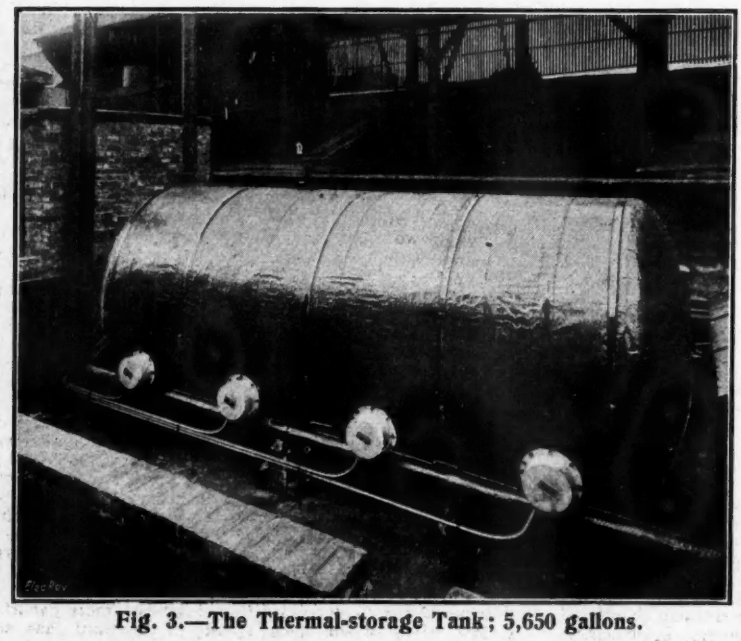


Fig. 3.—The Thermal-storage Tank; 5,650 gallons.

The alternative to the above method of heating would have been the installation of a steam boiler, and each of the 24 tanks would have had to be fitted with a steam trap, and, further, a connection to the steam trap would have had to be taken through the bottom of the tank. The necessary joint would always have been a possible source of leakage, allowing valuable electrolyte to escape to the floor of the plating-room. Further, the replacement of a heating coil could only have been carried out by empty-

ing the tank, whereas with the scheme actually in use this can be done by merely breaking the joints and lifting the heating coil out of the tank. It should also be remembered that the demand for heating is very heavy early in the morning, when the tanks are being brought up

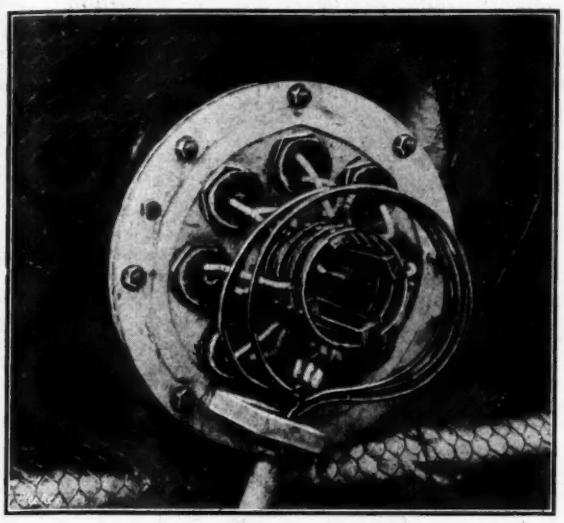


Fig. 4.—End of Heater Bank, showing Bus-bars and Connections.

to temperature. It would therefore have been necessary to start firing the boiler a few hours before the beginning of the day's work, so as to reduce the danger of boiler-priming, and for the remainder of the day the boiler would have been working inefficiently on a very light load, to maintain the vats at the necessary temperatures.

It will thus be seen that electrical thermal-storage heating has simplified the installation of the heating coils in the tanks, and has also made the system much cleaner and easier to maintain. Labour has been reduced, because the operation of the thermal-storage cylinder is entirely automatic, and the

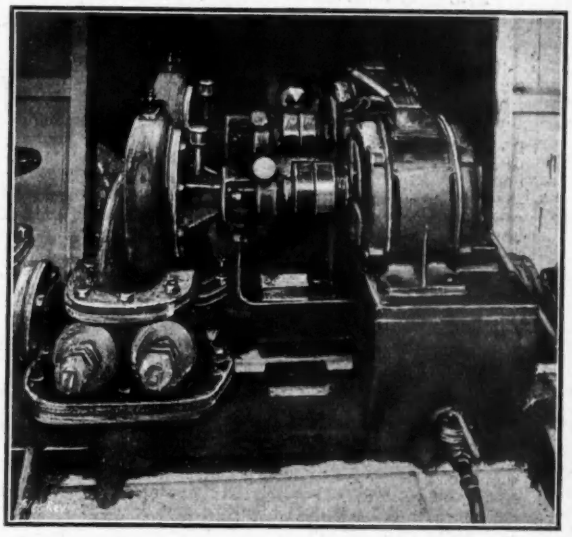


Fig. 5.—The Hot-water Circulating Pumps; Thermostat at Back.

only labour involved is that of opening and closing the stop-valve, and starting up or shutting down the circulating pump at the required times.

The equipment was installed by Messrs. R. W. Cairns, and the lagging of the pipe system and the thermal-storage boiler was carried out by Newells Insulation Co., Ltd.

Steam-turbine Nozzles.

Summary of the Sixth Report of the Steam-nozzles Research Committee of the Institution of Mechanical Engineers.

THE Steam-nozzles Research Committee was formed by the Council of the Institution of Mechanical Engineers in 1914 for the purpose of carrying out experimental work relating to "the action of steam passing through nozzles and steam-turbines." During the 1914-18 war the research had to be postponed, but in 1921 the apparatus was finally assembled and the experimental work commenced. Since then the work has been continuously carried on; the Committee presented five reports, covering the progress of the experimental work up to the end of the year 1927, and the sixth and final report was recently discussed before the Institution. It indicates that the work of the Committee has consisted, for the main part, of a series of measurements of the efficiencies of many and various forms of steam-nozzle over a range of steam speeds from 300 to 2,000 ft. per second.

A subsidiary departure into efflux angle measurement yielded results of sufficient importance to justify its consideration as a separate line of investigation. The results obtained in this field, while they have not been pursued as far as their practical interest would warrant, have revealed important facts with regard to the phenomena of stability of operation and variability of discharge angle in the flow of steam through nozzles.

The tests of various types of impulse and reaction nozzles have shown that there is no serious diminution of efficiency as the steam speed is reduced; on the contrary, there is in many cases a considerable improvement at speeds of less than about 600 ft. per second. The knowledge that there is no inherent disadvantage in the use of low steam speeds in nozzles has doubtless been one of the factors contributing to the general reduction of the steam speeds in recent turbine practice.

With impulse nozzles of the cast-in plate type the use of long throats is detrimental to their efficient functioning. The effect of throat length is apparently connected with the discharge angle, being much more pronounced in 20 deg. nozzles than in those of 12 deg. angle. The use of thick division plates produces an appreciable percentage decrease in the efficiency, but this disadvantage may be overcome almost entirely by suitable chamfering of the plates at the downstream edges. In 0/1 throat nozzles with thin, or suitably chamfered thick plates, there appears to be little difference in efficiency, on the average, between nozzles of 20 deg. and 12 deg. discharge angle. With long throats, however, the 20 deg. nozzles are considerably the more efficient.

The presence of solid surfaces in any position in the immediate neighbourhood of the steam jet, where they may impede the circulation of the steam between the nozzle and the impulse plate, has an adverse effect upon both the stability of operation and the apparent efficiency of the nozzles. Where steam emerges from two or more channels in close proximity it appears esssential, for the highest efficiency, that the openings on the downstream side of the nozzles should be close together and separated only by a fine edge of metal; otherwise a region of reduced pressure is formed between the jets which is a cause of instability and deviation in the direction of the jets, and of an additional and unnecessary loss of energy.

Straight nozzles of various kinds gave efficiency values superior to those of the curved nozzles, and those with artificially roughened surfaces indicated a loss of efficiency from this cause of up to 6 per cent. in the worst cases. A comparison of two geometrically similar nozzles, of ½-in. and 1½-in. diameter, respectively, showed no appreciable difference in velocity coefficient. A series of convergent nozzles of constant length and throat area, but with differing shapes of cross-section, gave energy efficiencies of the order of 98 per cent., and showed that in nozzles of this type the efficiency was hardly affected by the shape of the cross-section. With parallel-side nozzles having a sharp corner at the entrance, however, there was a difference of efficiency in favour of the nozzles of least perimeter.

To determine whether the results of the tests, which were normally made with the nozzles discharging into a space where the pressure was approximately atmospheric, could be considered as applying equally to other pressure conditions, a number of nozzles were tested with a back pressure of 60 lb. per sq. in. absolute, or four times the usual value. No change in the efficiency could be detected, however, and it was concluded that the rate of change of efficiency with alteration of steam pressure must be very small.

In two cases an increase of temperature of an average value of about 30 deg. C. decreased the efficiencies, more particularly at low values of the steam speed; in the third case an in-

crease of about 130 deg. C. increased the efficiency at the higher speeds only. Though the effect is by no means negligible, and is not as yet completely understood, it appears that any alteration of efficiency with steam temperature is not sufficiently great to affect to any large extent the amount of the gain which is known to be obtainable from the use of high-temperature steam in turbines, as the result of considerations other than that of nozzle efficiency.

The efficiency of a curved nozzle is also dependent upon the value of the radius of curvature of the mean path of the steam, the effect of increasing the radius being to raise the efficiency over the range of speed which would normally be employed in such nozzles. The amount of the improvement depends on other factors, being least for a large-angle long-throat nozzle and greatest with short-throat length and small discharge angle. In the nozzles tested, which had cast-in division plates of uniform thickness, the average increase in velocity coefficient brought about by doubling the radius of curvature of the plates was a little less than 1 per cent.

The manner in which the steam approaches and enters the nozzle appears to be of considerable importance with regard to the reduction of energy loss. In this connection, the effect of removing sharp edges at the entrance to nozzles has been studied for both straight and curved forms. In the former, improvements of up to 20 per cent. in the efficiency were found when the entrance corner was rounded off in the form of a circular arc of $\frac{3}{8}$-in. radius. The increase of efficiency resulting from the rounding of the corners at the sides of the entrance to a 20 deg. curved nozzle to a radius of $\frac{3}{4}$ in. was about one per cent. In a 12 deg. curved nozzle the improvement was so small that it could not be detected. Tests on the effect of roughened, as compared with smooth, radiused entries to straight nozzles indicated a reduction of the velocity coefficient of about one per cent. in cases in which the roughness in the bore of the nozzle is not too pronounced. In cases in which the bore is exceedingly rough the conditions of entry are overshadowed, so far as roughness is concerned. The importance of good entrance conditions is definitely established, both in straight and curved nozzles, as a feature of great moment in efficient nozzle flow.

With the presentation of this report, the Committee brings to an end a research which has extended over a period of eight years. The objects of the inquiry have been attained, and much supplementary work has been undertaken.

The Power Plant of I.C.I., Ltd.

A descriptive account of the large pulverised-fuel, high-pressure, high-temperature, industrial plant installed by Imperial Chemical Industries, Ltd., for supplying steam and electricity to the Billingham-on-Tees factory of Synthetic Ammonia and Nitrates, Ltd.

By H. A. HUMPHREY, M.I.E.E. D. M. BUIST, M.I.E.E., and J. W. BANSALL, A.M.I.E.E.

(*Extracts from a paper read before the* Institution of Electrical Engineers.)

Apart from its size, the plant possesses the following features:—

(1) A maximum steam pressure of 800 lb. per sq. in. gauge and a maximum temperature of 856 deg. F.
(2) The world's largest high-pressure pulverised-fuel boiler plant, having special constructional features for the high pressure and temperature.
(3) An unusually large water distillation plant.
(4) A 7-stage feed-heating system, with feed-pumps specially designed for high pressure and temperature.
(5) High-pressure pass-out turbines of unique design.
(6) The first system of its kind of automatic frequency control, automatic steam-pressure control, and automatic feed-pump regulation, together with automatic synchronising.
(7) Unusual lay-out features for the accommodation of pipework and cables.

The conditions governing the design of the power plant described differ essentially from those relating to a public electricity supply station. The extension programme of Synthetic Ammonia and Nitrates, Ltd., at Billingham called for 6,930 tonnes* of steam per day delivered for process purposes, and 37,500 kW distributed as electrical energy to the works. The quantity of process steam is approximately double the amount required to generate the electrical energy, and so the boiler capacity is three times that of a purely electrical station. Again, the load factor of a chemical works approaches closely to 100 per cent. and continuity of supply is of the utmost importance; cessation of supply not only causes loss of output, but also disorganises the steady conditions of temperatures and presures upon the maintenance of which satisfactory operation depends throughout a very complicated process. The power plant must, therefore, have sufficient stand-by plant and means of bringing it rapidly into operation, whilst, further, the lay-out, methods of control, size of units, &c., must all be considered on the lines of "safety first."

Another matter that influenced the design was the existence of large powdered-fuel-fired boiler plant and also the fact that a contract for a bulk supply at 11,000 volts, 40 periods, from the adjacent North Tees station continues until 1941.

Boiler Plant.—Existing boilers provide steam used in the factory at 290 lb. absolute and 653 deg. F., and the necessity of paralleling with these conditions made their adoption for the new plant almost imperative. The first problem was how best to raise steam at some higher pressure so that after some of its energy had been converted to electrical energy it could be passed on as process steam. The normal working pressure at the boilers was finally fixed at 815 lb. maximum. By adopting still higher pressures a slightly greater calculated efficiency would have been possible, but, in view of the fact that 856 deg. F. was considered to be the highest safe temperature for ordinary steel superheaters, and that such high temperatures have a greater influence on economy than super-high pressures, any temptation to adopt still higher pressures was readily rejected. Only 60 per cent. of the steam would be condensed and returned from process, so 2,512 tonnes of raw water, obtained from Billingham Beck, had to be distilled per day and added to "make-up" boiler feed. This involved the erection of an unusually large distillation plant, with its attendant de-aerators.

Turbo-Alternators.—Consideration of the possible economy to be obtained by progressive feed-heating led to the adoption of separate feed-heating turbines from which the steam is bled to heat the boiler-feed water. Commercial maximum economy, rather than a theoretical maximum, was aimed at and no attempt was made to bleed the primary turbines. These unusual machines were advisedly kept simple and comparatively small, and the consulting engineer insisted, in the interests of flexibility, on their being mechanically independent of other units. By passing all the steam required as such, plus that required for conversion to electrical energy, through two primary turbines 23,800 kW would be obtained, so that two units of 12,500 kW each would provide the working units and one was to be added as a spare. A corresponding set of feed-heating turbines would give 9,500 kWh output for two units working, and they were fixed at 6,000 kW each on the generator side.

Lastly, because the proportion of steam energy to electrical energy distributed to the works was liable to vary, condensing sets were necessary to meet such variation within the required limits and to make up the balance of the electrical output. One working condensing set to produce 10,200 kW would meet the then known conditions, another machine being kept as spare. They were made capable of 12,500 kW each in view of unknown requirements, and provision was made for a third set, should it be required in future.

Complicated calculations were involved in correlating the output and input of all the plant units, and in the end the steam to be raised by the new boilers was found to be 11,700 tonnes per day, and the electrical energy required was augmented to 43,500 kW in order to cover all the internal requirements of the plant, plus the outside load.

Costs.—The estimated cost of electrical energy at the busbars of the station is well below the unit cost of any electricity generating station in the world depending on coal as fuel. This is due to the use of high-pressure and high-temperature steam, to the use of primary turbines passing a greater quantity of steam than would be available in an ordinary central station, to the low cost of coal in the locality, to the high load factor, to the abundant supply of cooling water, and to the many economies introduced into the designs.

Erection.—The station was erected in record time. Tenders were invited in December, 1927, contracts were placed in February, 1928, excavations were commenced in May, 1928, and by February, 1929, the station was erected with sufficient plant to commence operation and give an external supply to the factory.

Lay-out.—The steam flow from the boilers to the high-pressure turbines, thence to the feed-heating and the distillation plants, and finally back to the boilers, constitutes a simple ring with a tee-off to the condensing sets and one to the factory for process purposes. A separate bay accommodates the high-pressure steam receivers, de-super-heaters,

* One tonne=1,000 kg=2,204 lb.

reducing valves, all interconnecting pipework, and valves (in short, a control centre, analogous to an electrical control room) for all high-pressure and low-pressure steam distribution. The power station is adjacent to the River Tees, from which ample cooling water is obtained.

The power plant is divided into three complete units, which are interconnected at various points on the steam and electrical sides, each unit extending across the entire five bays. The north and south boiler houses each contains four multi-drum boilers normally generating 215,000 lb. of steam per hour at 715 lb. per sq. in. The intervening pulveriser house contains six 15-ton roller mills and four 15-ton ball mills. The air for combustion is raised to about 500 deg. F. by preheaters.

The flue gas is discharged through economisers, air preheaters, and de-dusters, the grit and ash being discharged into sluices along which it is washed into a slurry whirl pit, pumped to a settling pit where the water drains off, and an overhead grab raises the ash and drops it through a chute into buckets on an aerial ropeway by which the ash is conveyed to barges at the riverside for dumping at sea.

The accommodation of the pipework in one bay around a symmetrically placed receiver system facilitates control of the steam flow by valve tables mounted on the turbine floor-level, immediately above the receivers; this compact arrangement gives complete flexibility.

The main generating units, three 12,500-kW high-pressure, pass-out, or primary, turbines and two 12,500-kW intermediate-pressure condensing turbines (provision has been made for a third condensing machine should it be required at a future date) run at 2,400 r.p.m. and are directly-coupled to 13,750-kVA alternators, 3-phase, 40 cycles, at 6,600 volts. A cable basement extending underneath the main turbine bay terminates in three cable ducts leading under the pipe bay to the feed-heating turbo-alternators. In addition, vertical and horizontal cable galleries in the switch house allow of clean unimpeded cable runs to the various portions of the switchgear and to the control room, an unorthodox feature. The extra building cost incurred was amply recovered in the consequent facility.

Steam Flow.—Steam is normally generated at 715 lb. per sq. in., the maximum working pressure being 815 lb. per sq. in. and the temperature 856 deg. F. On leaving the superheaters the steam passes into the high-pressure receivers (primary receivers), where its pressure is in the neighbourhood of 650 lb. per sq. in.; these receivers function as equalisers and distributors to the reducing valves and the primary turbines, being admitted to the latter at 645 lb. per sq. in. and 833 deg. F. Under normal operating conditions the reducing valves remain closed, while each of the two high-pressure turbines running takes some 244 tonnes of steam per hour and generates 11,900 kW at an overall efficiency of 74 per cent. Steam exhausts at 290 lb. per sq. in. from the primary turbines into the de-superheaters, or secondary receivers, where the superheat is maintained constant at 243 deg. F., corresponding to a total temperature of 653 deg. F., by means of a thermally-regulated water spray. Under certain conditions of steam and electrical loads steam is automatically diverted from the high-pressure turbines and passed from the primary to the secondary steam receiver system through one or more of the reducing valves. From the secondary receiver system the steam is distributed to the following points: process plants; condensing turbines; feed-heating turbines; 7th-stage feed-water heaters; and distillation plant, air ejectors, and soot-blowers.

The process plants normally consume 6,980 tonnes of steam per day, which represents very nearly 60 per cent. of the boiler output. Of this quantity 3,994 tonnes per day is returned in the form of condensate to the feed-water storage tanks in the power station, so that the net consumption to be replaced by distillate amounts to 2,936 tonnes per day, or 42 per cent. of the total quantity delivered by the three outgoing steam mains.

The condensing turbine under normal operating conditions takes 1,130 tonnes of steam per day and gives an output of 10,200 kW at an overall efficiency of 76 per cent.; it exhausts into its condenser at 0.58 lb. per sq. in., or a vacuum of 28.82 in. of mercury.

The regenerative feed-heating system comprises seven stages, the feed water being progressively heated from the initial temperature of 84 deg. F., at which it leaves the storage tanks, to a final temperature of 401 deg. F. Steam for the first two heaters is derived from raw water evaporated in the quadruple-effect distillation plant, the latter virtually functioning as a condenser for the feed-heating turbines. The steam for the next four heaters is bled from the feed-heating turbines, the bleeding points occurring immediately after the 6th, 12th, 18th and 24th (exhaust) stages of each machine. The last heater in the feed-water heating system is supplied with live steam direct from the secondary receivers, so that accurate adjustment of the final feed-water temperature may be obtained once the feed-heating turbine and its attendant distillation plant and heaters have settled down to steady operating conditions. This being the case, the two feed-heating turbines (normally running) each takes 1,310 tonnes of steam per day from the secondary receiver system, whilst their corresponding final-stage feed-heaters each accounts for a further 400 tonnes per day from the same source. Under these conditions each turbine generates 4,750 kW at an overall efficiency of 70 per cent., exhausting to its distillation plant at a pressure of 12.73 lb. per sq. in. and a temperature of 205 deg. F., whilst the net quantity of raw water distilled and passed into the feed line as "make-up" feed-water then amounts to 1,138 tonnes per day from each of the two distillation plants.

An examination of the steam and water quantities so far given reveals that the amount of distillate gained from the two feed-heating distillation sets is insufficient to compensate for the steam consumed by the process plants and for boiler blow-down losses and gland leakage in the high-pressure turbines. It was, therefore, necessary to install three further distillation sets deriving their steam supply from the factory's low-pressure steam main. Two of these sets can make up the deficit of 860 tonnes per day by the evaporation of raw water

The anticipated overall thermal efficiency of the power station is 24.2 per cent.

The contractors included the following companies:—

Boilers—International Combustion, Ltd.
Pumps and motors—Mather & Platt, Ltd.
Generating plant—Metropolitan-Vickers Electrical Co.
Switchgear—A. Reyrolle & Co.
Distillation plants—Vickers Armstrong, Ltd.
Cables—W. T. Henley's Telegraph Co., Ltd.
Distribution boards—Parmiter Hope & Sugden.
Economisers—E. Green & Sons.
Fans—Keith Blackman & Co., Ltd.
Motor convertors—British Thomson-Houston Co.
Motor starters—Allen West & Co., George Ellison, Ltd.
Pulverised coal equipment—Internl. Combustion, Ltd.
Superheaters—Superheater Co., Ltd.
Switchgear (d.c. board)—Bertram Thomas.
Transformers—British Electric Transformer Co.

Discussion in London.

Mr. H. A. HUMPHREY read a summary of the paper, after which Mr. D. M. BUIST drew attention to the rapidity with which the plant had been erected, and explained various special features of the installation. A kinematograph film illustrated the automatic control of the plant and a large model of the lay-out of the station was on view.

Mr. C. H. MERZ thought the methods by which the various problems encountered had been solved were particularly instructive. The station had been designed as a separate entity because of the then uncertainty about the frequency finally to be adopted in the district. The use of standard structural steel work had facilitated erection, but when time did not press established practice would be cheaper. Moreover, the operating cost would be higher when the plant was spread over a large area; there would not be any need to depart from the more usual lay-out in future. Why had there not been greater advance in the use of high-pressure steam in this country? Certainly not because of trouble due to the high pressure. The author's arrangement avoided the need for re-heating steam and if the North Tees plant had to be re-designed as a separate station to-day they would probably come to the same conclusion as the authors. Their claim that the Billingham plant would produce cheaper electricity than any other was not correct. Existing stations in various parts of the world were producing cheaper energy than that station could ever do, that aspect being governed largely by the cost of fuel. The I.C.I. plant had been designed to operate as a separate entity and another like it would not be built. The correct procedure in future would be association with the national grid, electricity production being left to balance itself, so that process steam and its regulation only need be considered. It was unfortunate that such an important installation had had to be built before advantage could be taken of the national grid.

Mr. W. M. SELVEY agreed with the previous speaker that the provision of cable galleries was not novel. The use of the word "cheaper" (electricity) was unfortunate, as the phrase did not convey the authors' intended meaning. The horizontal design of station would not be adopted in future, but it was useful for piping lay-out. The necessity for utilising existing boilers and the need for providing a large quantity of make-up feed-water had been the dog's tail, and a large one too. The superheater design was outstanding, and the arrangement of the special high-pressure turbo-generators was extremely interesting; when the results obtained from the latter were published they would be eye-openers.

Mr. T. R. WARREN referred to the effect of system frequency on the voltage, and pointed out that the automatic method of controlling frequency described by the authors was applicable to system control, such as the British grid.

Mr. H. W. CLOTHIER said the plant had been designed on "safety first" lines; there must be an unfailing supply of secondary steam for process work and it was accordingly significant that automatic control had been adopted. Sequential relay operation was preferable to permissive control. The crux of automatic systems was simple infallible relays to give "clean" operation.

Mr. H. RISSIK dealt with the removal of flue dust and ash. There were three methods; the centrifugal system was the most common, but it only removed the larger particles. The electrostatic system was probably the best, but was not favoured because of its high cost. Washing removed both dust and also most of the sulphur content of the gas. The Billingham de-dusting equipment was the first of its kind to be installed in this country; it was most promising and had an efficiency of at least 90 per cent., but required a considerable quantity of water. In the latter respect the I.C.I. plant was fortunately situated.

Automatic Convertor Sub-stations.

A description of the equipment which is being manufactured by the English Electric Co., Ltd., for the Ise Electric Railway of Japan.

RECENTLY we witnessed at the Stafford works of the English Electric Co., Ltd., a demonstration of one of three complete automatic convertor sub-stations which the company is manufacturing for the Ise Electric Railway of Japan. The capacity of each sub-station is 4,000 kW, and the d.c. pressure is 1,500 volts. Each equipment includes four 1,000-kW, 750-V rotary convertors, working in pairs in series. The e.h.p. supply to the sub-station is three-phase, 60-cycles, 11,000 volts. The essential component parts of the equipment are: an 11,000-volt, three-phase, 60-cycle, truck-type switchboard; two 2,100-kVA indoor-type, step-down transformers, each with double-wound secondary windings for supplying two convertors in series; four sets of l.p. and a.c. starting and controlling relay panels, with cam-shaft controllers; two common relay panels; four 1,000-kW shunt-wound rotary convertors, with directly-coupled exciters, 900 r.p.m.; one set of 1,500-volt d.c. switchgear, including track feeder breakers; and a desk-type control board. The sub-stations may be described as for fully automatic operation, with supervisory control in the stations themselves. Apparently the "subs" will sometimes be operated by a visiting attendant, but time-switch control is provided for in addition to push-button governing. Another unusual feature, the explanation of which appears to be bound up with Japanese psychology, is that the whole of the cam-shaft operating equipment is to be left exposed after it is installed, as it is shown in the illustration, fig. 2, and not shielded as in general practice.

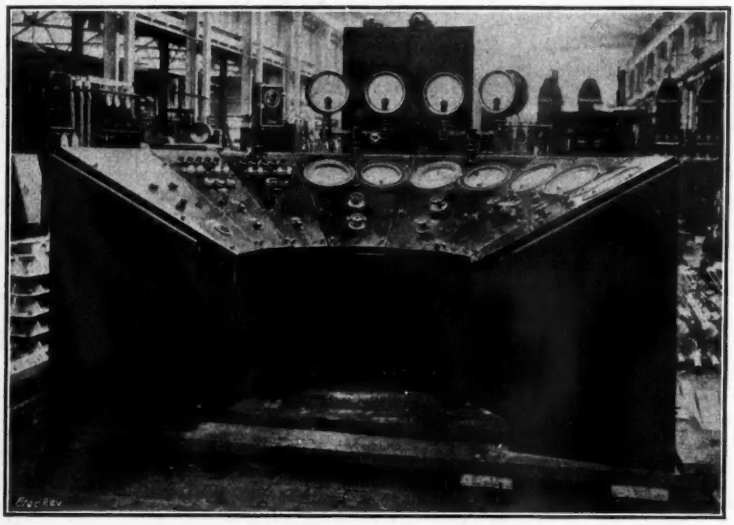


Fig. 1.—The Desk-type Control Board.

The incoming supply to the automatic and auxiliary equipment is controlled by one feeder supply oil circuit breaker which can be closed by the control switch on the desk control board, or by hand operating gear, if desired. After making the supply available, the first unit, consisting of two machines, can receive its starting impulse, either from a time switch or from a "start" push-button on the control desk. The second unit will be brought into operation by a prolonged overload on the first unit by means of an overload relay, or by the operation of the machine thermostat.

Normal shut down is effected in the following sequence. If both units are running, the unit which came into operation last will shut down first, through the operation of its underload relay and the underload-relay timing device. The other unit will shut down through the operation of the time switch or that of the appropriate "stop" push button. Should both units be running when the time switch comes into operation, both units will shut down. Whether the station is operating under time-switch or push-button control, the order of starting is determined by the position of a two-way triple-pole starting sequence tumbler switch on the control desk, which must be set beforehand to give priority to either unit. The sets shut down in the reverse order to that in which they start.

The following protection is incorporated. For incomplete start, a.c. leakage, overspeed, hot bearings, field failure, wrong polarity and failure to synchronise, a.c. overload, single-phase starting, and d.c. leakage, the unit or units are locked out and have to be restarted by hand. An a.c. under-voltage or failure shuts down the station, but the machines can start again on removal of the abnormal conditions. A d.c. reverse current shuts down the unit, which can start again when the conditions are normal. If one unit is running, an overheated machine causes the second unit to start. Further heating opens the d.c. "machine" high-speed circuit breaker and contactor, but allows them to re-close when the unit has cooled down; the unit continues to run. A d.c. overload locks out the d.c. breakers after three attempts at re-closing. Figs. 2 and 1 show, respectively, the complete sub-station equipment and the desk-type control board, as they appeared on the English Electric test bed.

The rotary convertors are started by means of low-voltage tappings on the transformers, and are provided with roller bearings. The English Electric Co. has specialised in the use of roller bearings on tap-started rotary convertors, and the

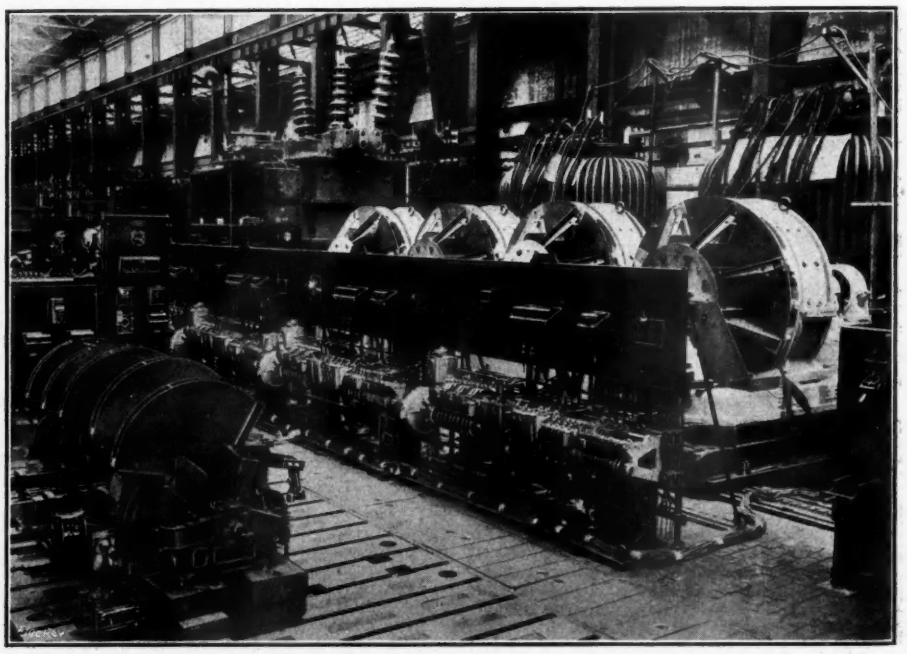


Fig. 2.—Complete Sub-station Equipment before Shipment.

disadvantages usually laid against this method of starting have now been overcome, and, therefore, the saving in first cost, and also in the space occupied due to the omission of the starting motor, can be fully realised. The use of roller bearings obviates the need of a brush-lifting device, and therefore the starting operations are just as simple and straightforward as for a pony-motor started machine. With roller bearings also the starting current taken from the h.p. mains is reduced to a figure which compares favourably with that taken by a motor-started convertor, and in order to reduce the current rush when changing from the tap volts to the full voltage of the transformer the company has developed a three-stage start in which an intermediate step connects the full voltage through chokers to the sliprings of the convertor, these chokers being designed to limit the current to a value which does not exceed the original starting current.

It is interesting to note that of the well over 100 rotary convertors supplied by the English Electric Co. to Japan during recent years, not one has been started by means of a pony motor, and the several repeat orders indicate that the English Electric Co.'s system of tap-starting, with roller bearings, is one deserving the serious consideration of engineers dealing with this class of plant. The bearings are provided with a patented system of oil lubrication which is giving every satisfaction.

The main feature of the automatic control gear is the cam shaft controller by means of which the main starting operations are carried out. This controller is a modified form of that used with success in the company's locomotive equipment. By means of this controller the various starting operations are carried out in a definite mechanical sequence, and its use obviates the need of a number of large contactors and their resulting intricate interlocking circuits. Normally the cam-shaft controller is housed in a sheet-steel cubicle on the front of which are mounted the various protective and other relays. The open type of cam-shaft controller used in this instance has, however, been built to the specification of the Japanese engineers.

A successful series of tests was demonstrated, but owing to the limitations of the test bed supply it was not possible to reproduce site conditions entirely, as sufficient power was not available to load up the first unit to an extent sufficient to bring in the second unit through the operation of either the overload relay or the machine thermostat. It was possible, however, artificially to reproduce the conditions by manually tripping the devices mentioned.

Kinema Studio Illumination.

Some of the British kinematograph film studios now employ incandescent-lighting equipment which rivals anything of its kind in existence, the amount of electricity and sizes of lamps utilised for this purpose being much greater than is generally realised.

By W. H. VILLIERS, B.Sc., A.C.G.I.

(*Extracts from a paper read before the* Illuminating Engineering Society.)

ONE of the most striking changes of recent years in the technique of kinematograph film-making has been in the method of lighting studio "sets," consequent on the development of incandescent lamps for the purpose in this country.

A few years ago the kind of film used was only sensitive to light from the blue end of the spectrum, and was hardly affected by yellow and red light. It was therefore necessary to use a light source emitting rays of the higher frequencies, and arc lamps and mercury-vapour lamps were almost universally employed.

The advent of the panchromatic film, however, did a great deal to alter the position; it is sensitive to light from the whole of the visible spectrum, so that much truer colour rendering is obtained than with ordinary film stock, and the light from incandescent gasfilled electric lamps run at certain efficiencies is of exactly the right kind for getting the truest colour rendering. Moreover, when talking films were introduced the hum and noise of arc lamps made it very difficult to employ them, even with the addition of an elaborate system of choking coils; additional advantages are: (1) energy consumption is saved, because more light is used where it is needed and camera filters are unnecessary; (2) less labour is required for the operation of incandescent lamps; (3) the light may be made more flexible; (4) there are no fumes or smoke; (5) there are no ultra-violet rays, which are injurious to sight; (6) the artists require very much less make-up, so that time is saved.

The lighting in a studio may be divided under five headings, each of a separate and distinct kind, achieved with a unit designed for its one purpose only, but all generally used on any particular set.

General lighting consists of flooding the set with diffused light of high intensity, usually by means of banks of lamps having a reflecting surface behind them. The number of lamps per bank varies from about six to forty, and the capacity of each lamp from 200 to 1,500 watts; 1,500 watts is gradually becoming the standardised size. Various reflecting surfaces have been tried, and aluminium has come into prominence, as it is very light and such reflectors are easily manipulated.

The lamps are arranged in three or four rows, with separate fuses and switches for each row, so that the amount of illumination may be controlled. In the largest models (about 1,800 kW) a blower is sometimes provided for removing the heated air, and thus keeping the holders and wiring cool. Bank-type reflectors are suspended above the set, in some cases mounted on stands and used as broadsides. In addition, smaller "domes" light a set which cannot readily be lit entirely by large bank-type reflectors. These are also constructed of polished aluminium in various shapes, and they accommodate smaller numbers of 1,500-watt lamps.

For *Close-up Lighting* near to the artist a single-lamp is more mobile and flexible than multiple-lamp units. The fitting most generally employed is an aluminium reflector mounted on a telescopic stand and equipped with one 1,500-watt gasfilled lamp; a diffuser is arranged in front of the lamp.

Spotlighting.—It is not possible to rely on general lighting alone when making films, as the photography would be quite flat and lifeless. It is necessary to produce high lights, shadows, and modelling; to accentuate certain features and characteristics; and also desirable to provide back lighting, which makes the players stand out in the picture and produces an artistic effect by outlining their features and hair with light (the lustrous golden hair of the film beauty is produced in this manner).

The spotlight fulfills these functions. A very high intensity indeed is required, because the spotlight must be capable of casting deep shadows and causing bright high lights in a set which is already brilliantly illuminated by the general lighting. The type which gives the best results for normal working and now most generally used is a 3,000-watt gasfilled projector lamp in a cylindrical house of about 18 inches diameter, with a silvered-glass parabolic mirror of special focus behind, so that the beam may be directed at any angle, and the stand of the lamp is so arranged that when used on the floor of the studio the lamp may be raised or lowered. It is possible to get wide- or narrow-angle beams by varying the focus of the lamp, and also to alter the diffusion, spread, and intensity of the light by the use of three or four types of detachable interchangeable mirrors. Provision is made for diffusers in front of the lamp, their main purpose being to cut down the intensity for certain special camera shots.

An "effect" spotlight provides the highest possible spot intensity from the smallest practicable lamp house, as it is often desirable to conceal the lamp in the middle of a set behind some object, such as a chair, for emphasising an important feature in the picture. Under these conditions it is not feasible to use the same optical system as with the 3-kW spotlight; therefore a spherical mirror is employed behind the lamp, which reflects the light rays back on to the filament, these passing normally through the bulb. In front of the lamp is a special short-focus lens, which is thin and of low absorption. A 2-kW lamp is used, its housing being approximately 9 in. in diameter.

Sun Lighting consists of the production in the set of a beam of light of very high intensity for such purposes as the representation of the sun's rays shining through a window; 5- and 10-kW gasfilled lamps in suitable houses are used, and maximum beam-candle-powers of about four million are obtained. The optical arrangements are somewhat similar to those of the 3-kW spotlight, but the amount of heat they produce increases the tendency towards blackening of the bulb, due to deposition of metal from the filament and its supports. Various types of 10-kW lamps have been developed with widely different characteristics. Some have chimneys above the filament, into which the hot gas rises and is cooled. This method succeeds in its object, but it is expensive and makes the lamps difficult to accommodate in housing which has to direct a beam at various angles. In others blackening is allowed to form, and tungsten powder is introduced into the bulb, so that when the lamp is inverted the blackening may be partially cleaned off by rinsing the powder round in the bulb; this method has found particular favour in America.

In some of the latest British projectors, which are probably the largest successful ones constructed, the bulb is made comparatively large and is cooled by means of a silent air blower; it is also kept vertical with gearing for all positions of the projector. This method has been very successful.

It is advisable to start up these large lamps through a resistance, which is cut out step by step, otherwise the initial current is of the order of 14 times the full-load current. One successful arrangement is a circuit breaker in conjunction with a resistance and an interlock, which makes it impossible to switch the lamps directly on to the mains without going through each step of the resistance.

Effect Lighting.—Incandescent lighting lends itself very readily to the production of special lighting effects in a set, as powerful lamps may be easily placed in positions where it would be difficult to accommodate other sources of illumination. For lighting the average set all the above apparatus is arranged somewhat as follows:—

Special bank-type fittings are slung overhead at an angle of about 30 deg. with the horizontal, flooding light down on to the set for general lighting, and on the floor about a dozen single-light fittings provide diffused light. Running round the top of the set is a wooden beam, known as the spot-rail, on which are clamped 3-kW spotlights (from 20 to 40 on a fair-size set) used for spotlighting and backlighting, and further 3-kW spotlights are arranged on the floor for front and side lighting.

Effect spotlights may be readily concealed close to the artists for modelling, and if the effect of daylight is needed, say, from a window, a sunlight spotlight equipped with a 10-kW lamp is placed outside the set; the diameter of the spot of light is adjusted until it just covers the window and appears to come downwards.

The lighting of a picture is thus provided by widely different types of incandescent light sources, all blended together to form the lighted picture as seen on the screen.

A Display of Modern Lighting.

An Exhibit by E.D.A. and E.L.M.A. at Charing Cross.

NO one in the electrical industry should miss the opportunity of seeing the modern lighting exhibit arranged by the E.L.M.A. Lighting Service Bureau and the British Electrical Development Association, which is on display during the current month in the booking hall at the Charing Cross underground station.

The stand itself is divided into three interiors with the addition of two built-in windows, and a considerable amount of exterior lighting is provided by various luminous features in the form of flashing opal cubes, lamp pylons, &c. Fig. 2 illustrates the near elevation of the stand, showing the demonstration room.

Perhaps the most striking interior is the lounge (fig. 1), which has been designed entirely on architectural lighting lines, and will undoubtedly be a revelation to the many thousands who will see this exhibit. Its object is to illustrate the possibilities of "furnishing with light."

The demonstration room, situated on the opposite side to the lounge, presents many outstanding features which will undoubtedly exert a considerable influence on the public mind and react favourably to the benefit of the electrical industry. Perhaps the most ingenious demonstration in this room is the three-colour cornice lighting, controlled by three photo-electric cells which can be operated by members of the public placing their hands over apertures in a front pedestal.

Fig. 2.—The Demonstration Room.

Fig. 1.—The Lounge.

Each beam of light interrupted in this manner brings on one colour of lighting in the cornice, and the combinations of colours obtained in this manner by the use of red, green and blue lamps produces remarkably pleasing effects. This particular demonstration is appropriately entitled "Controlling Light with Light—The Electric Eye." Other features of this room will not fail to attract attention, since the majority of the effects are unique in character and educational in nature. These exhibits include a novel system of indirect ceiling lighting, two remarkable colour lighting recesses, a mirror lighting demonstration, and one of the familiar Lighting Service Bureau lamp cabinets.

The "House You Want" sign recessed into one of the walls of the stand is instructive and an excellent piece of development propaganda. This exhibit was designed by the Electrical Development Association.

The model "all-electric" kitchen, complete with washing machine, cooker, floor polisher, &c., flashes from good to bad lighting in conjunction with a telling electric sign, while two window displays which are built into the structure will undoubtedly prove most instructive to the public. One of these windows shows the E.L.M.A. "Lady of Light" display in a new and improved form, while the other indicates the advance in lighting from the crude oil lamp to the modern electric lamp, and, incidentally, shows the improvement in efficiency on a basis of candle power per heat unit consumed.

Two external lighting features in the form of stainless steel pylons some 13 ft. 6 in. in height (loaned by Messrs. Thomas Firth and Sons, Ltd.), serve to emphasise the modern tone which is noticeable throughout the whole exhibit.

In reviewing the display as a whole, one is impressed with the fact that artificial light is attaining its true status as an art, and plays an important part in furnishing, decoration, and architecture.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

A New Switch.

The new "Tucker-Titan" switch, fig. 1, recently introduced by Messrs. J. H. TUCKER & Co., LTD., Kings Road, Tyseley, Birmingham, is claimed to embody all the features of the B.4000 type, except that it is somewhat smaller in construction (base 2 in. diameter, projection over dolly 1 9/16 in.). The movement fitted is quick-make and quick-break with complete positive action, as distinct from initial positive action, the contact arm being controlled throughout its entire movement by the "dolly"; the spring acts merely as an accelerator. In consequence, the switch would still operate in the event of the spring failing. The cover, which is made of brown or white moulded "Telacite," is secured to the base by two fixing screws which, by means of a special

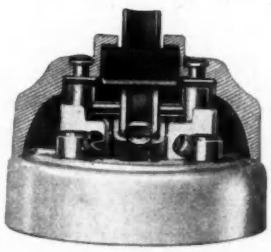


Fig. 1.—"Tucker-Titan" Switch, showing Interior and Cover Fixing.

device, are permanently retained in the cover, so that they cannot become detached and get lost when removing the cover to fix the switch. A test has been carried out on a one-way switch taken from the makers' stock at random, and the following results obtained: On a 250-volt d.c. non-inductive load, with 100 per cent. overload, the switch completed 100,000 operations without electrical or mechanical breakdown or damage. The provision of a creepage barrier in the cross-arm bearing pillar is a valuable feature when the switch is used in humid or moist atmosphere.

A New Prepayment Meter Lock.

The usual method of hanging a padlock on the outside of prepayment meters, has, it is claimed, the disadvantage of clumsy appearance, of taking additional packing space, and of tempting the lock picker or breaker. The A.E.G. ELECTRIC CO., LTD., 131, Victoria Street, S.W.1, claims to have overcome these weaknesses by the new design illustrated in figs. 2 and 3. The lock is fitted in the front of the till and is flush with the surface of the meter. An additional advantage

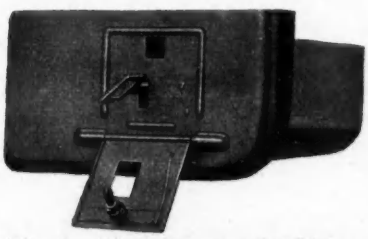


Fig. 2.—Flush Paper-sealed Meter Lock, open.

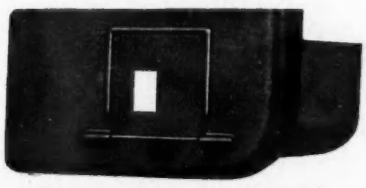


Fig. 3.—The Lock Closed.

of the new lock is that a paper seal can be inserted, so that any attempt at tampering can be immediately detected. As a further safeguard, the paper used for sealing may, of course, be provided with an identity stamp, number or water mark.

A Dust Protective Appliance.

We have received from the Chloride Electrical Storage Co., Ltd., Clifton Junction, near Manchester, particulars of the "Lane" respirator which has been designed by the medical officer responsible for the health of the company's workpeople, and is available for use in all industries in which a dust hazard exists. The outstanding features claimed for the respirator are: it is *comfortable* to wear; it automatically makes a perfectly airtight joint with the face, by reason of the feather-edge which, when a negative pressure is produced within the respirator on inhalation, is drawn tightly against the face; the rigid part of the apparatus is made of a non-corrodible composition, ensuring freedom from damage by acids or moisture; it is so designed as to fit any adult face; it is hygienic; by a simple arrangement of valves the filter is kept dry, and although it is usual to change the filter after 8 to 12 hours, in many cases it can be used for much longer periods; the standard type of filter provided is extremely efficient against dusts composed of very fine particles; other types of filter can be used when protection is merely required against coarser dusts or fibres.

A New Magnetiser.

Messrs. RUNBAKEN MOTOR & ELECTRICAL ACCESSORIES, LTD., Ardwick, Manchester, have recently introduced an appliance for the quick magnetising of magnetos. The complete magneto is placed in position in the apparatus as shown in the illustration, fig. 4, and the current is switched on; in a few

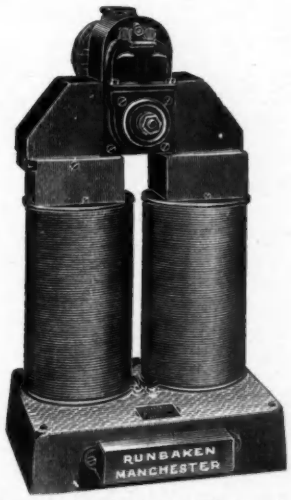


Fig. 4.—A Magneto Magnetiser.

seconds, it is claimed, the work is completed. Waste of time is eliminated, and magnetic losses are avoided.

The winding is such that at normal loading the apparatus operates at 50,000 ampere turns.

A New Electric Trolley-'bus Controller.

The latest advance made by the ENGLISH ELECTRIC CO., LTD., Queen's House, Kingsway, W.C.2, in the development of electric trolley-'bus design is the fitting of a compressed-air operating mechanism to its foot-actuated controller. This simple, but efficient, device relieves the driver of all physical strain when accelerating the vehicle or applying the electric brake. The controller itself is of the company's standard camshaft type, and is specially designed for ease of examination and maintenance. The novel feature consists of a compressed-air operating head which moves the controller step by step under the control of a small air-valve actuated by the driver's pedal. This pedal requires no more pressure than the accelerator pedal of a motor-car, and the controller moves up one notch each time the pedal is depressed. As soon as the foot-pressure is completely removed, the controller returns in one movement to the "off" position. In the case of 'buses which are equipped with air-brakes, the same compressed-air supply is used for the brakes and for the controller. 'Buses not so equipped have a small electrically driven compressor added to their equipment. The air-operating mechanism can be fitted to any standard "English Electric" trolley-'bus controller.

Swimming Bath Heating.

The public baths at Lichtenberg (Berlin) are warmed by waste heat from the Klingenberg power station.

An interesting example of the ultilisation of the waste heat of steam power stations in connection with public baths is situate in the Berlin suburb of Lichtenberg, where the Klingenberg super-power station, fig. 2, of the Berlin Electricity Supply Works Co., is located. At the time the station was built the local authorities of Lichtenberg also constructed open-air baths nearby on the banks of the River Spree. The bathing establishment comprises a swimming pool 110 yards in length, flanked by two smaller pools and a sand beach, in the middle of which is a paddling pool for children.

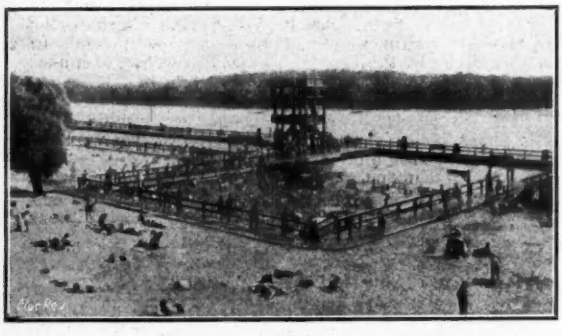


Fig. 1.—The Condenser-water Warmed Bathing Pool.

The cooling water for the power station condensers is drawn from the river by means of a three-sectioned concrete inlet canal, 8 ft. by 7 ft. section, regulated by sluices, and when the plant is further extended a second similar inlet canal is to be constructed. After passing through sieve chambers and condensers the water is returned to the river Spree, part of it *en route* being directed by a pipe 300 ft. long to supply the smaller bathing pool, fig. 1, with warm water. In the normal way 10 per cent. of the cooling water required by the station flows through the branch pipe. This percentage can, however, be increased by diminishing the cross-section of the main canal behind the tapping-off point by dam beams. The average temperature of the Spree water is approximately as follows: in the summer months about 68 deg. F.; in the winter months about 38 deg. F. The cooling water demand of the station naturally fluctuates with the lead, and, with the present plant working at full load, reaches a figure of 485 cu. ft. per sec., whereby the admissible temperature increase of the water is 50 deg. F. The velocity of the water in the inlet canal is 39 in. per sec.; at the end of the covered-in outlet canal 60 in. per sec., and in the open section of the latter from 31 to 32 in. per sec. The warm bathing pool can be maintained at a temperature of from 40 to 50 deg. F. higher than the river water, by regulating the water flowing in the inlet canal and that flowing through the cooling-water pumps in the station, and also, by altering the ratio of the water passing to the warm pool through the branch canal, to the total cooling water quantity. In this way the public can avail itself of the baths at no loss of comfort from the very early spring right up to the late autumn, whereas the low temperature of the water experienced at other open-air bathing establishments renders this impossible. A further convenience is that the warm pool can be used for the "first plunge," so that at all periods of the year bathers do not feel the difference in temperature of the air and colder water in the larger pool so keenly.

The main essential for the success of such establishments is clean water. At Lichtenberg the water undergoes a purifying process before it enters the cooling-water pumps and condensers. Therefore, by exercising great care that the water is immune from every impurity, especially oil, the water in the warm pool is cleaner than that in the other pools of the baths. The attraction which the Lichtenberg open-air baths has for the public may be gauged from the fact that, according to "A.E.G. Progress," the number of visitors during a successful bathing year is approximately half a million, reckoning the daily average in the bathing months at about 3,200 persons. In the first bathing month of 1929, which was still in the cold season, more than 30,000 bathers were recorded. The idea of utilising the cooling water needed by a power station for bathing purposes might also be successfully extended to indoor baths in the winter-time, as it would afford them the advantage of flowing water and the elimination of the present costly method of providing warm water.

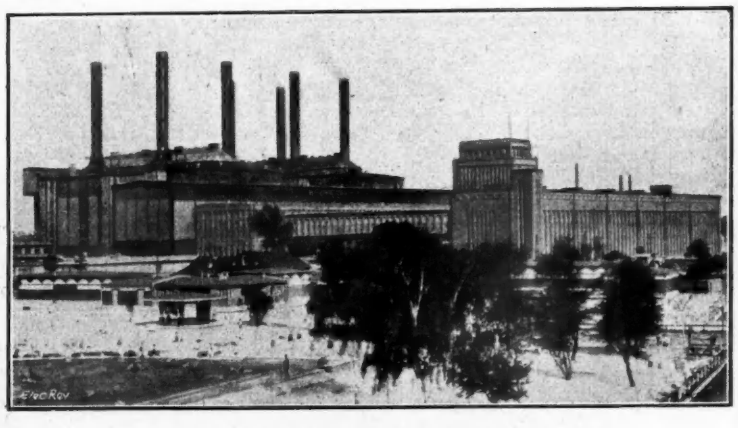


Fig. 2.—The Klingenberg Power Station.

Parliamentary News.

[By our Special Parliamentary Reporter.]

The Lighting of Railway Coaches.

On March 11th Mr. Hacking asked the Lord Privy Seal whether, in view of the fact that there were still, approximately, 30,000 gas-lit coaches on British railway steam-operated rolling stock, representing about 50 per cent. of the whole, he would consider the advisability, in the interests of employment and public safety, of making a condition, in connection with Government grants or loans to railway companies, that they should convert this dangerous system to that of lighting by electricity.

Mr. Thomas said that the figure of 30,000 appeared to relate to the number of gas-lit coaches at November 1st, 1928. Since that date, the railway companies had made further progress with the conversion of their gas-lit coaches in the normal course. The following proposals (which were additional to the ordinary programme) involving expenditure under this head had been included by the companies among the works which they were undertaking in fulfilment of their obligations to the Government in connection with the repeal of the Railway Passenger Duty: The Great Western Railway, £80,000; the London, Midland & Scottish Railway, £208,840; and the London & North-Eastern Railway, £56,000. It was understood, however, to be uncertain whether the last item of the above would be proceeded with. In addition, the London, Midland & Scottish Railway Company had obtained a grant under the Development Act in respect of the expenditure, estimated at £287,500, involved in the substitution of electric lighting for gas in a further 1,250 coaches. The Minister of Transport had made representations on several occasions within the last few years to the railway companies as to the desirability, in the interests of safety, of accelerating their programme of substituting electric lighting for gas in their passenger coaches, and he would renew such representations if it appeared that the process of conversion was not proceeding at a satisfactory rate. In view, however, of the large expenditure involved, he did not consider that the railway companies could reasonably be asked to undertake the conversion of the whole of their passenger stock at once, or that a condition such as that suggested could be attached to any grants made to them. Apart from the gradual conversion of their existing stock, the practice of the railway companies was to fit all new passenger stock with electric lighting equipment, with the exception of certain restaurant cars in which gas was utilised.

Gas and Electricity Finance.

On March 12th Mr. Daggar asked the President of the Board of Trade if he would state the profits of the companies' and local authorities' gas undertakings in Great Britain for

the years 1911 to 1929, and the price paid per ton for coal; and similar particulars with regard to the generation of electricity and the production of coke.

In a written answer, Mr. W. R. Smith, Parliamentary Secretary to the Board of Trade, included tables giving the profits of statutory undertakings for the years 1911-1928 inclusive, except that no particulars were available for the war years 1914-1918, and also similar particulars for the years 1921-1928 as regarded authorised electricity undertakings (supplied by the Ministry of Transport), there being no official information available in respect of earlier years. He said that no corresponding information as to the coke-oven industry was available. He also gave the price paid per ton for coal by electricity undertakings.

The tables showed that as regarded statutory gas undertakings the total paid-up capital of company undertakings rose from £75,379,271 in 1911 to £83,063,256 in 1921, and £89,771,505 in 1928. The corresponding figures for municipal undertakings (total borrowed) were: 1911-12, £42,149,338; 1921-22, £53,770,157; 1928-29, £70,590,646. Thus the total of all statutory undertakings for 1928-29 was £160,362,151. The capital expenditure of authorised company electricity undertakings rose from £51,600,747 at the end of 1921 to £112,933,507 at the end of 1928. Municipal electricity undertakings' capital expenditure increased from £92,115,513 in 1921-22 to £184,743,505 in 1928-29. The total capital expenditure of authorised electricity undertakings for 1928-29 was £297,677,012. The gross surplus (excess of receipts over expenditure) in the case of gas companies was £5,113,810 in 1911; £4,281,882 in 1921; and £7,063,021 in 1928. For municipal gas undertakings the figures were: 1911-12, £2,936,283; 1921-22, £1,507,413; and 1928-29, £4,924,507. The total for all statutory gas undertakings in 1928-29 was thus £11,987,528. The gross surpluses of electricity undertakings were as follows:—Companies: 1921, £4,062,258; 1928, £10,357,553. Local authorities: 1921-22, £7,751,580; 1928-29, £15,498,315. Total 1928-29, £25,855,868.

The average cost per ton of coal and coke used in the generating stations of all authorised electricity undertakings (coke representing only one or two per cent. of the coal tonnage) was as follows:—1921-22 (coal stoppage), 35s.; 1922-23, 20s. 5d.; 1923-24, 20s. 2d.; 1924-25, 20s. 8d.; 1925-26, 18s.; 1926-27 (coal stoppage), 31s. 2d.; 1927-28, 17s. 10d.; 1928-29, 15s. 7d.

Metropolitan Railway Bill.

It is announced that a settlement has been arranged with objectors to certain clauses of this measure, and the Bill has now been referred to the Unopposed Bill Committee of the House of Commons. The object is to empower the company to raise £500,000 of new capital and to construct about 4¼ miles of railway to Little Stanmore.

Scottish Power Bills.

It has been decided that the powers sought by the Scottish Central Electric Co., the Fife Electric Power Co., and the Lochaber Water Co., are not such as can be granted by means of Provisional Orders by the Secretary of State for Scotland. The measures will therefore be introduced as private Bills.

The Telephone System.

On March 11th, Mr. LEES-SMITH informed Mr. Freeman that the total number of telephones in Great Britain and Northern Ireland on January 1st in each of the years mentioned was 175,300 in 1900, 610,600 in 1910, 897,173 in 1920, and 1,886,726 in 1930. Particulars of the numbers of subscribers were only available as regarded the Post Office system, and only for the years 1920 and 1930. Those figures were approximately 535,000 and 1,127,000, respectively.

Railway Electrification.

On March 12th Mr. EDE asked the Minister of Transport if he would state the mileage of railway lines radiating from Newcastle-upon-Tyne that were regarded by him as suburban; the mileage that had been electrified; and whether he was taking any steps to secure that an additional mileage, especially including the lines to South Shields and Sunderland, should be electrified at once.

Mr. MORRISON said that 68 track miles of running lines in the Tyneside area had been electrified. As would no doubt be appreciated, it must rest primarily with the railway company concerned to decide the priority of schemes for the improvement of its system, and he did not propose at present to press the company further with regard to that proposal.

Welded Pressure Vessels.

An investigation into electric-arc (and other) fusion welding as applied in the manufacture of unfired pressure vessels recently undertaken by the author's company is described in a paper recently read before the Institution of Mechanical Engineers by Mr. L. W. Schuster. The paper contains instructive data and an appendix sets out tentative rules which have been framed to govern the construction of such vessels by that method.

Legal.

Sayers v. Electramonic Co., Ltd., and Others.

FOR three days last week, in the Chancery Division, Mr. Justice Farwell had before him an action by Mr. H. W. Sayers, the managing director of the Electramonic Co., Ltd., against that company, and Sir Philip Dawson, Mr. C. L. Kempton, Mr. C. B. Richmond, and Mr. E. A. B. Snoaden, who were formerly directors of the company. Mr. Sayers asked for an injunction restraining the defendants from hindering him in his position as managing director; he also claimed damages. Opening the case, his counsel (Mr. Harold Christie) said that as the defendants had resigned from the company and his client had been reinstated as managing director, an injunction was not necessary. Mr. Sayers had also offered to waive his claim for damages, but the offer was not accepted. That and the matter of costs were the questions to be settled. Counsel gave the history of the Electramonic Co. from its constitution in March, 1928, when Mr. Sayers was appointed managing director for seven years at a salary of £1,000 a year. There was friction between him and his co-directors, and in August last he obtained an interim order restraining his co-directors from interfering with him. In the following month they gave an undertaking not to hinder him in the course of his duties.

Mr. SAYERS gave evidence and was cross-examined by Mr. G. O. Slade for the defendants. Later Mr. Slade maintained that the plaintiffs' evidence was false and that the defendants never interfered with him. Sir Philip Dawson and Messrs. Snoaden and Richmond gave evidence.

His Lordship dismissed the claim against the directors and awarded them costs and that against the company without costs.

Wynsor Electric Range Co., Ltd.

MR. JUSTICE MAUGHAM, in the Companies' Court on March 17th, adjourned for another 14 days the petition of Mr. W. D. Stevens, Stamford Hill, for an order for the compulsory winding-up of the Wynsor Electric Range Co., Ltd.

Mr. HECKSHER, for the petitioner, said that he was a creditor for £100. On the last occasion a director of the company appeared and asked for an adjournment. Mr. Pocock now appeared for the company and asked for a further adjournment, which he (Mr. Hecksher) did not oppose.

Symphony Gramophone and Radio Co., Ltd.

MR. JUSTICE MAUGHAM, in the Companies' Court on March 17th, made an order for the compulsory liquidation of the Symphony Gramophone & Radio Co., Ltd., on the petition of the Plessey Co., Ltd., Vicarage Lane, Ilford.

Sir GERALD HURST, K.C., for the petitioners, said that the petition had been adjourned many times with a view to a scheme of arrangement being put forward which would be acceptable to the majority of the creditors. At a meeting on February 28th, the creditor approved the scheme conditional upon a certain sum in cash being found within 14 days. This sum was not forthcoming, and the scheme fell through. In the circumstances there was no purpose in further adjourning the petition, and he asked for a compulsory order.

Mr. GAVIN SIMONDS, K.C., said he appeared for 120 creditors whose claims totalled over £27,000 out of £43,000. They originally opposed the petition, but now withdrew their opposition.

Radio Research Board.

It will be recalled that the above-named Board was established in 1920 to assist in the co-ordination of radio research work carried out by H.M. fighting services and the Post Office, and to provide for research work of a fundamental nature in directions in which it was lacking. In the course of time the attention devoted to the second of these objects absorbed a considerably greater share of the Board's deliberations than the attention it was found necessary to devote to the first of them. Therefore in accordance with a recommendation of the Committee of Civil Research the Board has now ceased to be responsible for the direct co-ordination of Government radio research. In past years a section summarising the work of the Board has been included in the Department of Scientific and Industrial Research's annual report; but, as the published results of the researches carried out directly by the Board are attracting increasing attention both at home and abroad, the Board considers it desirable now to issue each year as a separate publication a more complete statement of the progress of the work carried out under its auspices. The first of the series of its annual reports, now available from H.M. Stationery Office, price 3s. 6d. net, reviews the work carried out from the formation of the Board to March 31st, 1929.

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

Motor Users and the Frequency Change.

Considering the zeal with which some motor makers have waged a dual-frequency motor *versus* part-exchange war, the criticisms of my article which you have received from both sides are milder than I expected—unless some are unprintable! I endeavoured to state the facts with impartiality, and in the spirit with which my principals are gladly catering for both schemes, knowing that each quite reasonably has its adherents.

With reference to Mr. Windibank's interesting remarks in the Electrical Review of February 28th and March 7th, the comparative capital costs given in my article were compiled from actual quotations received in the 25-cycle areas from five motor makers, including Messrs. Crompton Parkinson. What a conundrum Mr. Windibank appears to have set for those acquainted with present-day manufacturing costs, namely, to supply a new 50-cycle motor in part exchange for the scrap-metal value of a used 25-cycle motor of similar power and salient dimensions, plus "considerably lower" than 30 per cent. to 45 per cent. of the normal price of the 25-cycle motor.

In reply to "Cycle" in the Electrical Review of March 7th, I advise motor buyers to obtain performance guarantees in respect of dual-frequency motors because of several cases in which such motors have been found to exhibit on site such poor power-factors and efficiencies as to cause grave concern to their users. Insistence on such guarantees would operate in the interests of those firms that have developed creditable dual-frequency motors. Also, whereas I compared *apparent* efficiencies *at both frequencies*, "Cycle" refers only to efficiency at 50 cycles without any reference to efficiency at 25 cycles or to power-factors. It is a matter of fundamental principles that dual-frequency motors are at a disadvantage as regards the effectiveness of active materials. Such disadvantage must necessarily reflect on the efficiency, which fact I consider "Cycle" admits by his statement that dual-frequency motors have to be built in larger frame sizes, this obviously being necessary to dissipate extra losses consistent with the same maximum permissible temperature rise.

My conclusion, after investigating leading makers' various schemes of winding, is that one of the most serviceable dual-frequency windings for the stator is of lattice form (*i.e.*, two coil sides per slot) which apportions the disadvantage between the two frequencies. Other design factors being good, a squirrel-cage motor will then exhibit high running-up torque on both frequencies, without the need of high resistance end rings to prevent a tendency to crawling speeds; also with a slip-ring motor such a winding helps the designer to keep the rotor volts and amperes the same on both frequencies when one dual-frequency winding is used on the rotor. The delta-star two parallel method of stator connection is another aid to balancing the design for both frequencies. Motors thus designed have full load efficiencies on both frequencies so high as to be only 1½ to 2 per cent. below those of single-frequency motors designed to the same high standard. I still contend that these figures represent the very best modern practice, and are distinctly above the average for motors hitherto supplied.

Percy Huggins.

Manchester, *March 10th*, 1930.

Synchronous Motors.

In the Electrical Review of August 9th, 1929, a correspondent inquired the name of a good book dealing exclusively with the synchronous motor. On account of pressure of business at the time I was unable to answer this. Since then I have taken the opportunity of looking over the correspondence in your journal on the subject, and cannot help but agree with one or two of the writers that, without a knowledge of vector diagrams and, I might add, circle diagrams also, it is impossible to work out or understand the problems connected with alternating current phenomena, particularly with reference to the starting and running conditions of synchronous and induction motors. I, like your correspondent, have no knowledge of mathematics, but anyone thoroughly interested in the subject can learn a good deal without. The only book known to me that deals entirely with the synchronous motor is written by Blondel, of Paris, and translated by Gomport A. Adams (past president American I.E.E.), with a chapter added by him on the synchronous convertor and published by the McGraw Hill Publishing Co., New York and London.

The synchronous motor has been known for many years, but on account of its bad starting characteristics was never popular and, with the exception of a few cases, dropped out of use in favour of the induction motor.

However, on account of the high power factor of the synchronous motor, there has been a tendency of late to replace the induction motor by the synchronous type, but it is only of recent years that any comprehensive study has been made of its phenomena. Prof. Alfred Hay and Mr. Mawdawalla in a combined paper before the I.E.E. and American I.E.E. in Calcutta, India, January 2nd, 1919, stated that in 1913 E. Rosenberg read a paper before the I.E.E. on synchronous machines (I.E.E. *Journal*, vol. 51, p. 62, 1913), in which he considered among other things the occurrences during the starting period, and discussed in some detail the behaviour of the machine towards the end of the acceleration period just before it is pulled into synchronism. It may be mentioned that in the discussion on Fecheimer's paper (*Trans.* Amer. I.E.E., vol. XXXI, 1912, p. 529) it was stated by B. G. Lamme (late chief engineer, Westinghouse Co., U.S.A.), that it was "difficult to see just what is going on in the motor at the instance of pulling into synchronism." So far as the authors were aware Rosenberg's was the first attempt to furnish a detailed explanation of the action in question. The most recent addition to the literature of the subject is an article by Theo. Schou in the *Electrical World* (New York), April 6th, 1918. I could give your correspondent a list of a number of papers on the subject if he wishes, and is able to follow them up.

Personally, I find great difficulty here in Liverpool, as the public libraries do not keep the foreign technical journals, with one or two exceptions. The Liverpool University Library has most of them, but they are not accessible to the public.

Charles Rettie.

Liverpool, *March 15th*, 1930.

A Foreign Sales Department.

There seems to be no system or organisation in foreign countries for the pushing of British goods. We have nearly a thousand Consuls in various parts of the world. We have periodical bursts of "Buy British Goods" advertising. We have agencies of various firms, but still we seem to be behind other countries in the matter of gaining foreign contracts. As a matter of fact, the only foreign orders we seem to get are those where time and money seem to be no object. The competitive contracts where time and money *do* count do not come to Britain. America, Germany, and other countries have organised systems to such a high pitch that they can get information about all new work in good time for tenders to be submitted. The majority of the world's customers want British goods; they know they get good value for their money, but they are not going to waste time and money bringing those orders to us. We must go out after orders. The Department of Overseas Trade does a little bit towards this, but not enough, and it is too slow. I had a case given me the other day concerning an order in Central America. The order concerned a number of tractors, that were wanted in a hurry. It was a German salesman who got wind of the order first and started to get into cable communication with his firm. Then the representative of a well-known American firm came along. The American Consul got him a clear line to his firm, he obtained all the information he wanted, and beat the German by 10 days' delivery time and 10s. a tractor. The time was saved by the engagement of special trains and the chartering of a fast cargo boat—by the way the boat was built in England, manned by English sailors, but belonged to an American firm. Where was our trade representative? This contract ran well into five figures. We were asleep, as we have been since the war ended. I suggest that the big trade organisations in this country should join together and run a special foreign sales staff, not tied round by miles of red tape like the Consular staff. Men not afraid to use the cables. Men ready to travel miles as soon as they hear a rumour of an order. And our manufacturers must be ready to cut the odd shilling; the foreigner will buy British goods, he will give an extra shilling for the British article, provided he can get it in reasonable time. The manufacturer must also be prepared to speed his order on its way. I am a salesman myself and know that orders are lost owing to delay in delivery time. Let us wake up and form a Foreign Sales Department—not under Government control—that will go after and get orders and information about orders and we shall in time not only have no unemployed but will be working overtime.

Salesman.

March 14th, 1930.

[This letter has been abbreviated.—Eds. Elec. Rev.]

The City and Guilds Examination.

Mr. H. W. Nelson asks for information about the "City and Guilds" examination.

This examination is held as the final examination of a three years course in electrical installation work. An external student (that is a person not attending a class) can be examined provided that (1) he resides in a district in which there are no classes, or (2) that the nature of his employment prevents him from attending a class. If successful in the examination he will be awarded an "Electrician's Interim Certificate," endorsed "theory only." This can be later exchanged for the full "Electrician's Certificate" on furnishing the "City and Guilds" with satisfactory evidence as to the candidate's practical training and work.

I should advise Mr. Nelson to write to his county education secretary, and ask for information as to the nearest class, or he could write to the City and Guilds, 29, Rolands Gardens, South Kensington, S.W.7.

F. Peake Sexton.

London, S.W.11, *March 15th*, 1930.

Relative Costs of Gas and Electricity.

I regret if the wording of my letter led "Self Evident" to believe that I required "yes" or "no" for an answer, but I assure him that this is not so. I should be extremely obliged if he, or any other of your readers, would give me the information I asked for.

Arguer.

March 17th, 1930.

The Gas Department in your correspondent's district will state the number of therms per 1,000 cubic feet, but supposing it to be 5, then at 3s. 4d. per 1,000 cubic feet the cost of one therm is 8d. If heat units are to be supplied at the same price in the form of electricity the figure must be approximately ½d. per kWh.

The higher efficiency of the electric cooker helps to restore the balance, but your correspondent warns me not to dilate on this.

Perhaps some gas gentleman will tell us the maximum lumen hours per therm for an incandescent burner. We know the minimum.

G. W. Cotsell.

Edinburgh, *March 11th*, 1930.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1928.

24,019. "Television and the like." J. L. Baird and Television, Ltd. August 21st, 1928. (325,524.)

26,592. "Primary electric cells and batteries." Dr. A. Schmid and Metropole Developments, Ltd. September 17th, 1928. (325,483.)

27,161. "Television apparatus and the like." J. L. Baird and Television, Ltd. September 21st, 1928. (Cognate application, 28,463/28.) (325,527.)

29,477. "High-voltage rectification." V. Z. de Ferranti and Ferranti, Ltd. October 12th, 1928. (325,528.)

29,947. "High-frequency telephone systems." Telefunken Ges. für Drahtlose Telegraphie. October 17th, 1927. (296,952.)

30,184. "Electrical signalling systems." Automatic Telephone Manufacturing Co., Ltd., and G. A. Burns October 18th, 1928. (325,530.)

33,271. "Manufacture of boxes, cases, or similar containers, particularly for housing or containing switches and other electrical appliances." J. A. Crabtree and J. R. Dolphin. November 14th, 1928. (325,466.)

33,391. "Sound reproducers." Western Electric Co., Ltd. (Bell Telephone Laboratories, Inc.). November 14th, 1928. (325,478.)

33,642. "Method for introducing alkaline earth or rare earth metal vapours into evacuated or partially evacuated vessels." Standard Telephones and Cables, Ltd., and L. H. Bedford. November 16th, 1928. (325,534.)

33,643. "Thermionic cathodes for electric discharge devices." Standard Telephones and Cables, Ltd., and L. H. Bedford. November 16th, 1928. (325,492.)

33,811. "Reproduction of recorded sound by electrical means." H. Clarke and Gramophone Co., Ltd. November 17th, 1928. (325,535.)

33,853. "Provision of insulation coatings on aluminium or aluminium alloys." Associated Electrical Industries. Ltd. November 19th, 1927. (300,912.)

33,889. "Electrical measuring apparatus." H. Dutilh. November 19th, 1928. (325,506.)

33,935. "Radio apparatus." L. J. Gottlieb & Co., Ltd., and E. V. Kayley. November 19th, 1928. (325,511.)

33,945. "Switch arrangement for operating the hooter, for dimming the headlamp, and for switching in the light installation, and for operating the direction-indicator of a vehicle." G. Unterberg November 19th, 1928. (325,513.)

34,205. "Loud speakers." A. F. Pollock and D. A. Pollock. November 21st, 1928. (325,543.)

34,268. "Electric furnaces." Wild-Barfield Electric Furnaces, Ltd., and L. W. Wild. November 21st, 1928. (325,548.)

34,272. "Apparatus for the communication of signals by means of acoustic high-frequency oscillations." Electroacoustic Ges. November 23rd, 1927. (301,034.)

34,273. "Radio receiving apparatus." L. L. De Kramolin. December 1st, 1927. (301,498.)

34,283. "Telephone systems." J. E. Pollak (Associated Telephone and Telegraph Co.). November 21st, 1928. (325,549.)

34,346. "Electric connectors for electrically-operated appliances." G. H. Collins and H. F. Collins. November 22nd, 1928. (Cognate application 18,000/29.) (325,576.)

34,355. "Circuit arrangements for alternating-current relays with vibratory contacts." Standard Telephones and Cables, Ltd., and T. S. Skillman. November 22nd, 1928. (325,577.)

34,404. "Devices for protecting the shafts of electric motors and other rotary machines against displacement." W. Fluchter. November 23rd, 1927. (301,037.)

34,452. "Automatic switches for use in telephone or like systems." Associated Telephone and Telegraph Co. December 12th, 1927. (302,227.)

34,562. "Electric discharge lamps." S. Prisner and E. Wender. November 23rd, 1928. (325,592.)

34,671. "Electric buzzers, interrupters, and like vibratory devices." Stanfield Radio Co., Ltd., B. D. Feild, and T. C. Standbrook. November 24th, 1928. (325,598.)

34,677. "Dynamos." Rotax (Motor Accessories), Ltd., and J. E. Macfarlane. November 24th 1928. (325,599.)

34,691. "Simultaneous telegraphy and telephony systems." Siemens and Halske Akt. Ges. November 26th, 1927. (301,317.)

34,920. "Electric switches." A. Reyrolle & Co., Ltd., and A. Allan. November 27th, 1928. (325,603.)

35,502. "Means for securing the covers of boxes and electric switches." S. O. Bowker. December 3rd. 1928. (325,608.)

35,852. "Electrical selectors." Relay Automatic Telephone Co., Ltd., and B. B. Johnson. December 5th, 1928. (325,614.)

36,023. "Lightning or surge absorbers." E. D. T. Norris and Ferranti, Ltd. December 6th, 1928. (325,618.)

36,094. "Electric switches." H. F. McLoughlin and Simplex Conduits, Ltd. December 7th, 1928. (325,619.)

36,276. "Electric switches." International General Electric Co., Inc. December 8th, 1927. (301,933.)

36,391. "Coating of electric-lamp bulbs or other hollow bodies having a constricted neck portion." Westinghouse Lamp Co. December 9th, 1927. (302,170.)

37,050. "Electric connecting means for use in association with wireless sets and galvanic batteries and other electrical apparatus requiring periodical charging with electric currents." Oldham & Son Ltd., and R. S. Miller. December 14th, 1928. (325,632.)

37,639. "Shades for electric lamps." H. F. Anns. December 20th, 1928. (Cognate application, 1,672/29.) (325,634.)

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191 "Electric heating elements." Naamlooze Vennootschap Technisch Handels-Bureau Thabur. January 2nd, 1928. (303,420.)

703. "Preparation of refractory linings or crucibles for coreless electrical induction furnaces." N. R. Davis and Associated Electrical Industries, Ltd. January 8th, 1929. (325,661.)

2,781. "Long-distance electric cables." Siemens Schuckertwerke Akt. Ges. January 26th, 1928. (304,799.)

3,077. "Distribution of electric current." Sykes & Dyson, Ltd., P. Sykes, and W. Cooper. January 30th, 1929. (325,671.)

3,239. "Miners' safety lamps." D. W. Woodhead and D. Wenham. January 31st, 1929. (325,675.

4,204. "Electric lamp fittings." Revo Electric Co., Ltd., and F. H. Reeves. February 8th, 1929. (325,681.)

4,655. "Method and apparatus for braking tramcars and the like vehicles." W. S. Graft-Baker. February 12th, 1929. (325,684.)

4,958. "Electric cable terminals for telephone and like cables." Standard Telephones & Cables, Ltd., and E. Baguley. February 14th, 1929. (325,689.)

4,976. "Electrical connectors of the plug-and-socket type." C. L. Arnold and M. K. Electric, Ltd. February 14th, 1929. (325,690.)

5,363. "Electric switches." A. G. Decker. February 25th, 1928. (306,822.)

5,872. "Electrical resistances." W. B Smits. February 23rd, 1928. (306,552.)

6,172. "Reproduction of sound by electromagnetic means." C. Still. February 25th, 1929. (325,699.)

6,712. "Electric switches." A. P. Lundberg & Sons, Ltd., G. C. Lundberg, P. A. Lundberg, and G. Pegg. March 1st, 1929 (Cognate application, 33,109/29.) (325,706.)

8,549. "Electric cables." British Insulated Cables, Ltd., and J. L. Packer. March 16th, 1929. (325,718.)

9,315. "X-ray installations." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). March 22nd, 1929. (325,726.)

9,546. "Microphones." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. April 27th, 1928. (310,513.)

11,227. "Electrically-wound clocks." British Thomson-Houston Co., Ltd. April 12th, 1928. (309,548.)

11,405. "Means for combining electrical energies, modulating systems, and the like." Marconi's Wireless Telegraph Co., Ltd. April 12th, 1928. (309,557.)

12,198. "Electric machines comprising rotary working tools." R. A. L. Volet. May 10th, 1928. (311,371.)

12,222. "Train-controlling systems." Siemens & Halske Akt. Ges. June 20th, 1928. (Addition to 294,444.) (313,953.)

12,508. "Impulse starters for magnetos." D. Y. Wheatley. April 22nd, 1929. (325,747.)

13,050. "Plug connectors for use in draw-out electric switchgear arrangements." Siemens-Schuckertwerke Akt. Ges. May 24th, 1928. (312,312.)

16,005. "Production of beryllium alloys, in particular those with a high beryllium content, by means of fused electrolysis." Siemens & Halske Akt. Ges. November 13th. 1928. (325,762.)

16,813. "Electric locomotives." International General Electric Co., Inc. June 1st, 1928. (312,927.)

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330. "Electrodes for the electric heat-treatment of metallic articles." F. W. Thompson. October 18th, 1928. (Divided application on 30,213/28.) (325,552.)

2,836. "Wave-transmission systems such as systems for radio-telegraphy and radio-telephony." J. Robinson. August 10th, 1928. (Divided application on 325,232.) (325,481.)

2,837. "Wave-signalling apparatus, such as radio receivers." J. Robinson. August 10th, 1928. (Divided application on 23,076/28.) (325,482.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from March 12th:—

Frig-O-Matic (lettering and design). No. 508,373. Class 6. Electric refrigerating machines.—Dominion Blower Co., Ltd., Brantford, Ont., Canada. (British representatives: Boult, Wade & Tennant, 112, Hatton Garden, E.C.1.)

Limiphonic. No. 510,140. Class 8. Sound-reproducing apparatus, radio-telephonic apparatus, and radio-telephonic apparatus in combination with gramophones, and parts thereof.—Limit Engineering Co., Ltd., 17, Albion Street, N.W.7.

Paladin. No. 510,278. Class 8. Instruments and apparatus for radio signalling, thermionic valves, amplifiers, and sound reproducers, &c.—Mullard Radio Valve Co., Ltd., 45, Nightingale Lane, Balham, S.W.12.

Liver. No. 508,130. Class 13. Metal goods for electrical purposes, but not including lamps and like articles.—Liverpool Electric Cable Co., Ltd., Linacre Lane, Bootle, Lancs.

Engineering in Chile.

A paper prepared by Lt.-Col. J. Hartley, M.Inst.C.E., of Chile, and read by Mr. P. C. Dewhurst, M.I.Mech.E., before the Junior Institution of Engineers in London recently, reviewed the geographical and economic features of the country, with special reference to engineering activities. The cost and difficulty of railway construction due to the extremely rugged nature of the country were noted. Devious routes had to be followed; thus Santiago and Valparaiso, the two main cities, were joined by a modern up-to-date electric railway of 5 ft. 6 in. gauge which rose by easy grades up to the 2,500 ft. summit and was 116 miles in length. Several projected new lines included a tube railway under the Avenida Delicias, the main thoroughfare of Santiago, to be 2½ miles long. New steel works commenced at the Port of Corrall would cost 1½ millions sterling and employ electric blast furnaces of 50,000 tons capacity each, the electric power being obtained from the water falls at Huilo-Huilo. Copper mining formerly one of the principal minor industries, was now confined to three large mines and Chile to-day was the second largest producer of copper. Chile was the only South American country producing coal and most of that mined was found under the sea bed. Don Antonio Huneous, Chilean Minister in London, in expressing his pleasure that an English technical engineering Institution should display so much interest in the resources of his country, assured members that the work which British engineers had done in developing the resources of the country was appreciated by Chileans and that British goods were always very welcome.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ASHTON-UNDER-LYNE.—Additional housing scheme (147), for the T.C.; borough surveyor.

AYRSHIRE.—Factory at Irvine, for Scottish Knitting Mills, Ltd.; the manager.

BANSTEAD.—Nurses' home at Mental Hospital (£15,359); H. H. & F. Roll, Ltd., Epsom.

BEBINGTON AND BROMBOROUGH.—Housing scheme (62), Mersey Bank estate; U.D.C. surveyor.

BEXLEY.—Houses (56), Brampton estate, for S. H. Alabaster, Ltd.

BILLINGHAM.—Council offices (£12,700); U.D.C. surveyor.

BIRMINGHAM.—Extensions, Little Bromwich Hospital (£19,500); city engineer.

BOLTON.—Re-erection of Tonge Moor Cinema Theatre, for M. J. McVittie, Half Edge Lane, Eccles.

BRACEBRIDGE.—Admission block, &c., at Mental Hospital; Harold S. Hall, architect, Old Market Place, Grimsby (returnable deposit of £4 4s.).

BROOKWOOD.—Extensions, Mental Hospital (for 600 additional patients and staff), for Surrey C.C.; clerk, Kingston-on-Thames.

BURTON-ON-TRENT.—Houses (143), Horninglow estate; borough engineer.

BUXTON.—Housing scheme (40), Heath Grove (deposit £2 2s.); F. Langley, borough architect, Town Hall.

CHESTERFIELD.—Houses (100), Newbridge Lane; borough engineer. Extension of cinema, with shops and café, Holywell Street; H. J. Shepherd, architect, 87, Fargate (deposit £2 2s.). Hotel; W. H. Wagstaff & Son, architects (deposit £2 2s.).

CONSETT.—Houses (58); U.D.C. surveyor.

DARLINGTON.—Extension of library (£30,000); borough surveyor.

DEVON.—Schools (£28,000), for the E.C.; director of education, Exeter.

DONCASTER.—Cinema theatre, Thorne Moorends, for Moorends Empire, Ltd.; W. A. Kellett, architect, Lloyd's Bank Chambers, Barnard Castle (returnable deposit of £2 2s.).

DUNDEE.—Shopping and office centre, for directors of Lord Roberts Memorial Workshops; the secretary. Tramway depôt, Lochee Road; G. Baxter, surveyor, 97, Commercial Street.

DURHAM.—Fifty-five elementary schools and secondary schools, Hookergate, Stockton-on-Tees, Billingham, and Crook, for the County E.C.; director of education.

FALKIRK.—Public baths; Wm. Gibson, surveyor, Arnotdale, Camelon Road.

FALLOWFIELD.—Shops and showrooms, Wilmslow Road and Wilbraham Road, for Messrs. T. H. Davies; Arthur H. Walsingham, architect, 62, Market Street, Manchester.

FIFESHIRE.—Factory at Falkland, for Scottish Co-operative Wholesale Society; manager, S.C.W.S., Glasgow.

GLASGOW.—Baths and washhouses, Tradeston, for Corporation; city architect.

GLOUCESTER.—Additional 56 houses, for the T.C.; city surveyor.

GOLBORNE.—Housing scheme (54), for the U.D.C.; surveyor (returnable deposit of £2 2s.).

GRANTHAM.—Additional 52 houses, for the T.C.; borough surveyor.

HALIFAX.—Girls' High School, Craven Lodge; E. & T. Bower, builders, Rookery Lane, Salterhebble.

HARROGATE.—Secondary school (£72,200), for the E.C.; director of education.

HATFIELD (Doncaster).—Houses (200), Doncaster Road, for E. C. Dunn.

HOLBEACH.—Cinema theatre, for Holbeach Amusements, Ltd.; F. Burdett Ward, architect, 8, South Brink, Wisbech.

ILFRACOMBE.—Public offices, for the U.D.C.; surveyor.

IRLAM (Lancs.).—Schools (300 places), for the Catholic Trustees; Rev. J. S. Lineen, St. Teresa's.

IRISH FREE STATE (Dungarvan, Co. Waterford).—Alteration and additions, including electrical work, to laundry building at County Home; H. T. Spreadborough, engineer, Clifton, Youghal, Co. Cork (returnable deposit of £2).

(Clonakilty, Co. Cork).—Technical school; Ashlin and Coleman, architects, 7, Dawson Street, Dublin. (Returnable deposit of £3 3s.).

KINGSTON-ON-THAMES.—Houses (140), on the housing estate, for the B.C.; borough surveyor (returnable deposit of £2 2s.).

LINCOLN.—Additional 100 houses, for the T.C.; city surveyor.

LIVERPOOL.—Cinema, Green Lane, Tulbrook, for Carlton Entertainments, Ltd. Cinema, Breeze Hill, Walton, for Bedford Cinemas, Ltd.

LONDON (East Ham, E.).—Houses, Charlemont site (£111,420); borough engineer.

(Stratford, E.).—Extensions, Court House (£13,140), for Essex E.C.; J. Stuart, county architect, Chelmsford.

(Tottenham, N.).—Enlargement of St. Katharine's C.O.E. Training College; the Principal.

(Eltham, S.E.).—Covered market, with electrical work, for Woolwich T.C.; borough engineer.

MAIDENHEAD.—Extensions to Maidenhead Hospital (£16,600); E. Stanley Hall, architect, 54, Bedford Square, London, W.C.1.

MALTBY.—Housing scheme (40), for the U.D.C.; Morgan R. Jones, surveyor (returnable deposit of £2 2s.).

MOTHERWELL.—Housing scheme (60), for the T.C.; burgh surveyor.

NELSON.—Cinema and ballroom, Alkincotes; borough surveyor.

NEWTON-IN-MAKERFIELD.—Houses (178), Park Road estate for U.D.C. (deposit £1); J. Elston, architect, Market Street, Earlestown.

NORWICH.—Municipal buildings; R. Atkinson, architect, 36, Bedford Square, London, W.C.1.

NUNEATON.—Cinema and shops, Broad Street and Abbey Street; Cartwright & Son, architects, Market Street.

PONTEFRACT.—Housing schemes at Kellington, Whitley, Hillam, Monk Fryston, and Ferrybridge; Tennant and Smith, architects, Ropergate.

PORTSMOUTH.—Houses (48), Highbury estate, Cosham; C. and W. Mitchell. Extensions, Municipal College (£45,000), for the E.C. Aerodrome, Highgrove (£65,000); city engineer.

PURFLEET.—Additional 58 houses, for the U.D.C.; J. L. Davies, surveyor (returnable deposit of £2 2s.).

READING.—Offices, for Tramways Department (£8,000); Arthur Parsons, architect, Municipal Buildings, Blagrave Street.

ROTHERHAM.—Central library (£23,883); T. Wilkinson and Sons, Ltd., Sheffield.

RUGBY.—Extensions, Rugby Hospital; the secretary.

ST. IVES (Hunts.).—Housing scheme (40), for the R.D.C.; W. A. Lea, architect, 4, Market Hill, Huntingdon (returnable deposit of £1 1s.).

SOUTHPORT.—Hospital and clinic, Pilkington Road; A. E. Jackson, borough engineer (deposit £1 1s.).

STAFFORD.—County offices, for Staffs. C.C.; county surveyor.

STIRLINGSHIRE.—Reconstruction of part of Banton Mills, Kilsyth; the manager.

SURREY.—Schools, Coulsdon (£45,000); Dorking (£36,000); Selsdon (30,000); Bandon Hill (£17,000); Caterham Hill (£24,000); and Smitham (£17,000), for the E.C.; W. W. Finny, secretary, Kingston-on-Thames.

SWADLINCOTE.—R.C. church, Boardman's Hill; Rev. Father Parmentier.

SWINTON.—Houses (90), Wentworth Road; Sutcliffe and Shaw, builders.

TWICKENHAM.—Factory buildings, Edwin Road; Brewer, Smith & Brewer, architects, Richmond.

TYLDESLEY (Lancs.).—Housing scheme (52) surveyor to U.D.C., Town Hall (deposit £1 1s.).

WALSALL.—Houses (126), Brockhurst estate; Sabin and Young, Ltd., Scunthorpe. Houses (40), Little Bloxwich and Harden; Bert Denning. Tuberculosis hospital, Coscote estate; borough engineer.

WEST RIDING.—Senior school (1,200 places) at Goole (£43,000); director of education, County Hall, Wakefield.

WEST STANLEY.—Re-erection of Theatre Royal (£15,000), for Robert Reay, Chopwell.

WHITBURN.—School (£17,363); R. Stafford & Son, Sunderland.

WITHINGTON.—Houses (265) and shops (8) in Yew Tree Road, for A. Hartley & Son, Ltd.; Meller, Speakman and Hall, architects, 1, Cooper Street.

YORK.—Extensions York County Hospital, for the governors; E. Stanley Hall, architect, 54, Bedford Square, London, W.C.